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Water Resources Data
Michigan
Water Year 1988

U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-88-1
Prepared in cooperation with the State of Michigan
and with other agencies

CALENDAR FOR WATER YEAR 1988

1987

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U.S. DEPARTMENT OF THE INTERIOR
March 3 1849

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES

Water Resources Data
Michigan
Water Year 1988

by S.P. Blumer, J.C. Failing, W.W. Larson, C.R. Whited, and R.L. LeuVoy

U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-88-1
Prepared in cooperation with the State of Michigan
and with other agencies

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For information on the water program in Michigan write to
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U.S. Geological Survey
6520 Mercantile Way, Suite 5
Lansing, Michigan 48911

1989

PREFACE

This volume of the annual hydrologic data report of Michigan is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each state, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and quality of water provide the hydrologic information needed by state, local, and federal agencies, and the private sector for developing and managing our Nation's land and water resources.

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. In addition to the authors, who had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to Geological Survey policy and established guidelines, the following individuals contributed significantly to the collection, processing, and tabulation of the data:

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Water resources data for the 1988 water year for Michigan consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water temperature of ground water. This report contains discharge records for 138 streamflow-gaging stations; stage only records for 15 lake-gaging stations; stage and contents for 5 lakes and reservoirs; water-quality records for 20 streamflow-gaging stations; water-level records for 51 observation wells; and water-temperature records for 5 observation wells. Also included are 52 crest-stage partial-record stations and 8 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program. Miscellaneous data were collected at 180 measuring sites and 10 water-quality sampling sites. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, Local, and Federal agencies in Michigan.

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INTRODUCTION

The Water Resources Division of the U.S. Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Michigan each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Michigan."

This report includes records on both surface and ground water in the State. Specifically, it contains: (1) Discharge records for 138 streamflow-gaging stations, 52 crest-stage partial-record stations, 8 low-flow partial-record stations, and 180 miscellaneous sites; (2) stage only records for 15 lake-gaging stations; (3) stage and content records for 5 lakes and reservoirs; (4) water-quality records for 20 streamflow-gaging stations and 10 miscellaneous sites; (5) water-level records for 51 observation wells; and (6) water-temperature records for 5 observation wells. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, Local, and Federal agencies in Michigan.

This series of annual reports for Michigan began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the 1975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Michigan were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title "Surface-Water Supply of the United States, Part 4." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States," and water levels for the 1935 through 1974 water years were published under the title "Ground-Water Levels in the United States." The above mentioned Water-Supply Papers may be consulted in the libraries of the principal cities of the United States and may be purchased from U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as "U.S. Geological Survey Water-Data Report MI-88-1." For archiving and general distribution, the reports for 1971-74 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the District Chief at the address given on the back of the title page or by telephone (517) 377-1608.

COOPERATION

The U.S. Geological Survey and agencies of the State of Michigan have had cooperative agreements for the collection of water-resource records since 1930. Organizations that assisted in collecting the data in this report through cooperative agreement with the Survey are:

Michigan Department of Agriculture, P.E. Kindinger, Director, through Environmental Division, C.E. Lietzau, Director.

Michigan Department of Natural Resources, David F. Hales, Director, through Land and Water Management Division, D.J. Hall, Chief, and Geological Survey Division, T.R. Segall, Chief.

Michigan Department of Transportation, J.P. Pitz, Director.

Assistance with funds or services was given by the U.S. Army Corps of Engineers in collecting records for 12 gaging stations published in this report. Assistance was also furnished by the National Weather Service, National Oceanic Atmospheric Administration, and U.S. Department of Commerce.

The following organizations aided in collecting records:

Macomb County Board of Supervisors; Oakland County Drain Commission; Genesee County Drain Commission; Kalamazoo County; Wayne County; Huron-Clinton Metropolitan Authority; Cities of Ann Arbor, Cadillac, Clare, Coldwater, Flint, Imlay City, Kalamazoo, Lansing, Mason, Norway, Portage, and Ypsilanti; American Aggregate Co.; Consumers Power Co.; Cleveland Cliffs Iron Co.; Fisher Body Division; Mead Corporation; Michigan Power Co.; Michigan Sugar Co.; Swift-Eckrich, Inc.; Upper Peninsula Power Co.; and Wisconsin-Electric Power Co.

Organizations that supplied data are acknowledged in the station descriptions.

SUMMARY OF HYDROLOGIC CONDITIONS

Surface Water

In the Upper Peninsula, streamflow was in the normal to above-normal range from October to April. Streamflow dropped dramatically to the deficient range during May to July. Heavy rains in August returned streamflow to the normal range. At Sturgeon River near Sidnaw, streamflow was in the normal range in April, but had reached the deficient range by May, and in fact, declined to the second lowest monthly mean streamflow for May. Drought conditions continued through June and July which resulted in record-low monthly mean streamflows. The monthly mean flows for June and July were only 10 to 13 percent of the median. The instantaneous minimum streamflow for the year was less than that of last year but failed to surpass the period-of-record minimum recorded in September 1976.

In the Lower Peninsula, streamflow patterns were similar to those in the Upper Peninsula. Normal and slightly above-normal flows were recorded during October through April. The lack of precipitation during May through July caused streamflow to be deficient. Streamflow increased in August and September but the response was not as pronounced as that in the Upper Peninsula. Although the year will be remembered for the low flows during the last half of the year, higher-than-normal flows were recorded in December and April. Many stations in the Lower Peninsula recorded this years peak discharge in December or April.

In the Lower Peninsula, the drought of 1988 began as a seasonal decline in streamflow. The decline continued until July when rainfall began to reverse the trend. At Muskegon River at Evart, streamflow was deficient from May throught August; the monthly flows ranged from 44 to 76 percent of the median. The monthly mean flow for June at Evart was the lowest recorded in 56 years of record. At Red Cedar River at East Lansing, streamflow was deficient from May through July; the monthly flows ranged from 33 to 59 percent of the median. The monthly mean flow for June at East Lansing was the second lowest for the period of record. Figure 1 shows the monthly and annual mean discharge compared with the median discharge during water years 1951-80 at the three index stations.

New minimum discharges were recorded at several stations. Numerous other stations recorded extremely low flows. To assist in assessing the magnitude of the 1988 low-flow conditions, the 7-day, 10-year low-flow discharge (7 Q 10) was determined for selected stations. The minimum discharge and 7 Q 10 are shown below for only those stations at which the minimum discharge for the year was less than or equal to the 7 Q 10. The 7-day low-flow discharge is a statistic derived from the lowest mean flow recorded in 7 consecutive days for each year the station has been operated. The 10-year recurrence interval is the average number of years between flow occurrences of the described 7-day low-flow discharge. Only stations that are not appreciably affected by regulation, diversion, and irrigation demands are compared, because these stations tend to represent the natural hydrologic conditions. Streamflow at many stations downstream from flow-regulating structures were less than the 7 Q 10. It is not known whether the lowest flows downstream from regulating structures are entirely the result of regulation or the result of natural low flow, or a combination of both.

Station no.	Station name	1988 Water year minimum discharge (ft^3/s)	7-day, 10-year Low flow discharge (ft^3/s)
04033000	Middle Branch Ontonagon River near Paulding	60	74
04040500	Sturgeon River near Sidnaw	5.5	8.4
04045500	Tahquamenon River near Tahquamenon Paradise	157	199
04057510	Sturgeon River near Nahma Junction	32	46
04059500	Ford River near Hyde	18	29
04096515	South Branch Hog Creek near Allen	.48	2.4
04096600	Coldwater River near Hodunk	a 13	18
04101800	Dowagiac River at Sumnerville	a 97	108
04102700	South Branch Black River near Bangor	a 23	25
04105000	Battle Creek at Battle Creek	24	34
04105700	Augusta Creek near Augusta	15	17
04108600	Rabbit River near Hopkins	9.4	10
04108800	Macatawa River near Zeeland	.83	1.5
04112000	Sloan Creek near Williamston	.01	0.05
04117500	Thornapple River near Hastings	47	51
04121300	Clam River at Vogel Center	a 50	52
04121500	Muskegon River at Evart	a 304	313
04121900	Little Muskegon River near Morley	a 24	43
04122100	Bear Creek near Muskegon	a 2.2	2.6
04127918	Pine River near Rudyard	52	57
04129000	Pigeon River near Vanderbilt	a 29	43
04146000	Farmers Creek near Lapeer	.39	1.2
04148140	Kearsley Creek near Davison	a 1.6	4.2
04150800	Cass River at Wahjamega	a 16	22
04160800	Sashabaw Creek near Drayton Plains	.03	0.23
04161580	Stony Creek near Romeo	1.2	1.5
04176500	River Raisin near Monroe	a 24	43

a Occasional slight regulation by upstream dams

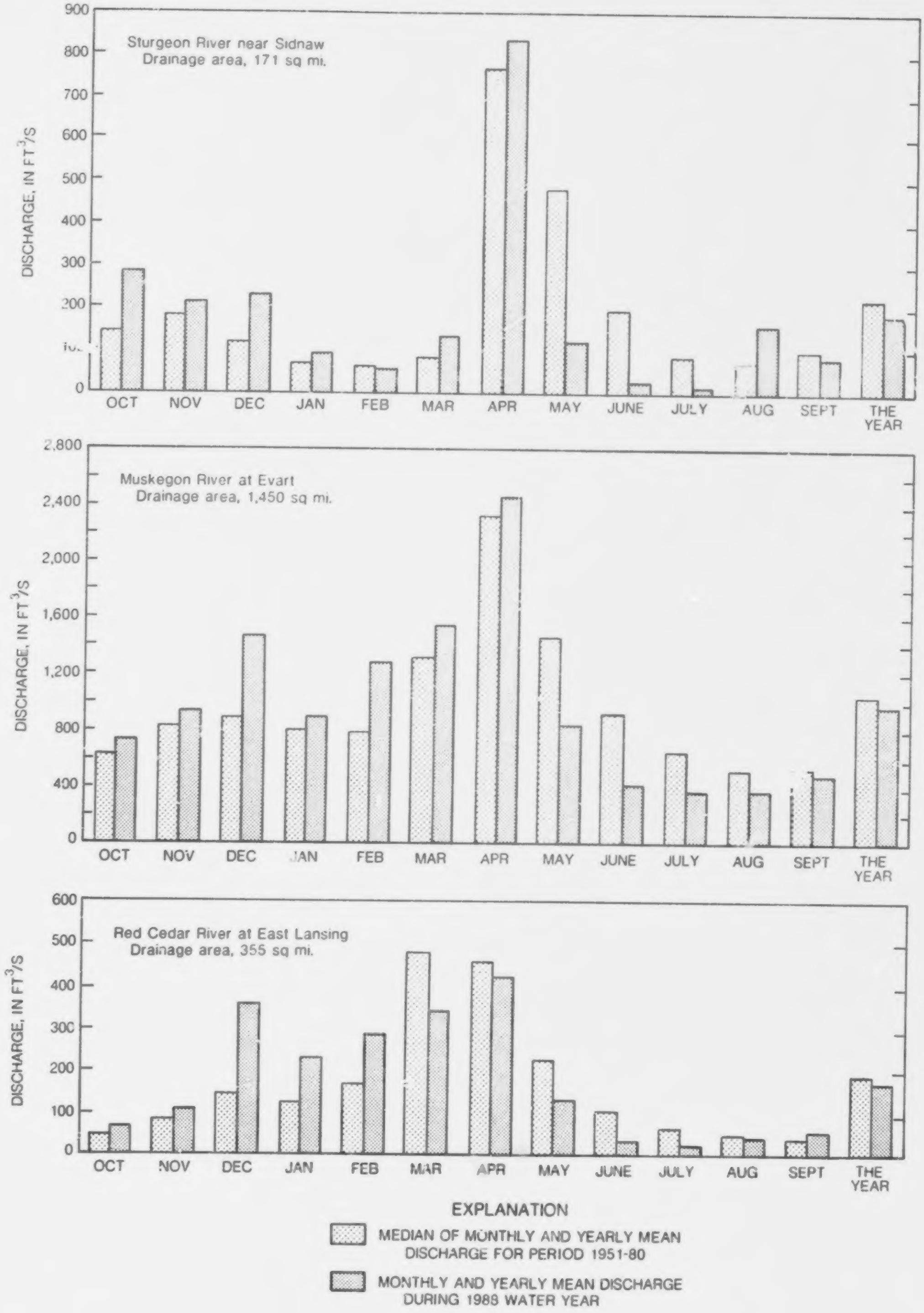

Figure 1.--Discharge during 1988 water year compared with median discharge for period 1951-80 for three representative stations.

Even though Michigan experienced a dry summer with below-normal runoff, Great Lakes water levels were well above the all-time minimums set for Lake Superior in 1925 and 1926, for Lakes Michigan-Huron in 1964 and 1965, and for Lake Erie in 1934 and 1936. In contrast to the past several years, the year-end water levels were about 1 ft (foot), 3 ft, and 2.5 ft below the record high levels set in 1985 and 1986 for Lakes Superior, Michigan-Huron, and Erie, respectively. Water levels of Lakes Michigan-Huron and Erie began the 1988 water year about 1 ft above the long-term mean water level. The levels of Lakes Michigan-Huron equaled the long-term mean by the end of June and ended the water year about 0.5 ft below the average lake level. The water level of Lake Superior was about equal to the long-term mean during October through April. During May through September, the lake levels were as much as 1 ft less than the long-term mean. Lake Erie water levels dropped slowly all year, nearly equaling the mean by the end of the year.

Water Quality

Surface-water-quality data were collected at 18 NASQAN stations in 1988. Concentrations of dissolved solids and suspended sediments, analyzed from samples collected bimonthly or quarterly at the stations, generally fall within the range of previous samples. Although data are collected on an established frequency, it is desirable to sample rivers at either high or low stage to determine water-quality characteristics at both extremes. During a period of high flow, runoff from the land is the dominant contributor to a river's discharge and chemical character. During a period of low flow, ground water usually influences a river's water discharge and chemical character. No high-flow samples were collected during the year. Numerous low-flow samples were collected during the summer months to determine the quality of below-normal runoff. In 1988, dissolved-solids concentrations measured during low-flow conditions generally reflected the large ground-water component of low flow on the chemical character of stream water.

Inland lakes upstream from several water-sampling stations tend to moderate the effects of high and low streamflow on measured water-quality characteristics. The quality of water collected at stations downstream from these inland lakes probably lessen the influence of this year's lower-than-normal summer streamflow.

Ground Water

The principal aquifers in Michigan are glacial outwash deposits and sandstone, limestone, and dolomite bedrock. The following table lists the aquifers and some of their characteristics.

Aquifer name and description	Well characteristics				Remarks
	Depth (ft)		Yield (gal/min)		
	Common range	May exceed	Common range	May exceed	
Glacial aquifers:					
Outwash: Mostly sand and gravel.	25-200	400	1-1,000	2,000	Water generally hard; iron concentrations common; deep wells may produce salty water in places.
Lacustrine sand: Mostly sand, some gravel.	25-100	200	80-500	500	Used for domestic supplies in Saginaw Bay and Detroit areas; is salty in places at depth.
Till: Intermixed clay, silt, sand, gravel and boulders; abundant sand and gravel lenses in some areas.	25-200	400	5-200	200	Primary source of domestic supply in western Upper Peninsula.
Bedrock aquifers:					
Saginaw Formation: Sandstone, siltstone, some shale, limestone, and coal.	25-300	500	100-300	1,000	One of Michigan's most important bedrock aquifers; water generally hard; salty in places at depth.
Marshall Formation: Sandstone and siltstone.	25-200	400	100-500	1,500	Another of Michigan's important bedrock aquifers; salty in places and at depth.
Silurian-Devonian rocks: Limestone and dolomite; some shale and sandstone.	25-150	200	10-300	500	Important aquifer in parts of eastern Upper Peninsula; water commonly hard.
Cambrian-Ordovician rocks: Sandstone, limestone, and dolomite.	25-150	200	10-100	500	Important aquifer in eastern Upper Peninsula; water commonly very hard; salty in places and at depth.
Precambrian sandstone: Sandstone interbedded with siltstone.	25-400	500	5-50	100	Important aquifer in western Upper Peninsula; salty in places.

Glacial deposits cover most of the State. The outwash sand and gravel in these deposits form the most productive aquifers in the State. Lacustrine sand also is very productive. Poorly sorted, relatively impermeable mixtures of clay, silt, sand, and gravel, that form some till deposits tend to be poor aquifers; clay deposits generally yield little or no water. In most areas of the State, glacial deposits are less than 200 ft thick. In the northern part of the Lower Peninsula, however, the deposits in some areas are greater than 800 ft thick. Sandstone, limestone, and dolomite are the principal bedrock aquifers. Where near enough to land surface to be recharged by precipitation, they yield freshwater. Where deeply buried, however, these rocks commonly yield brackish or salty water.

Annual recharge to aquifers in Michigan ranges from 3 to 18 in. (inches) and is derived from precipitation, which averages 31 in. annually.

Water levels were measured in 111 wells during 1988. Of these, 51 were selected to comprise a statewide network of observation wells (fig. 10), which is designed to provide statewide areal coverage and to define ground-water conditions in the important aquifers in the State. Water levels in the network of observation wells were generally below average at the beginning of the water year. Levels rose during the first 8 months of the water year and, by year's end, levels were near average despite the dry summer months. Levels were below average throughout the year only in the eastern Upper and southeastern Lower Peninsula.

Natural chemical characteristics of ground water in Michigan are determined primarily by the geologic environment through which the water flows. Natural ground water generally is suitable for human consumption and most other uses. Water from glacial deposits, at places, contains elevated concentrations of iron [2.5 to 5.0 mg/L (milligrams per liter)]; water from carbonate rocks is likely to be very hard (400 to 900 mg/L as calcium carbonate); and water from the Saginaw Formation in the Saginaw Bay-Thumb area commonly is very mineralized (2,000 to 80,000 mg/L of dissolved solids). Throughout the State, salty water underlies freshwater at depths ranging from about 100 ft in the eastern part of the Lower Peninsula to about 900 ft in the northern part. Average dissolved-solids concentration of water from bedrock (535 mg/L) is about twice as great as the average concentration from glacial deposits (241 mg/L) (Cummings, 1980).

REFERENCES CITED

Cummings, T. R., 1980, Chemical and physical characteristics of natural ground waters in Michigan--A preliminary report: U.S. Geological Survey Open-File Report 80-953, 34 p.

-----, 1984, Estimates of dissolved and suspended yield of stream basins in Michigan: U.S. Geological Survey Water-Resources Investigations Report 83-4288, 57 p.

SPECIAL NETWORKS AND PROGRAMS

Hydrologic Bench-Mark Network is a network of 58 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

National Stream Quality Accounting Network (NASQAN) is a nation-wide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water quality assessment and hydrologic research.

Radiochemical Program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 1988 water year that began October 1, 1987, and ended September 30, 1988. A calendar of the water year is provided on the inside of the front cover. The records contain streamflow data, stage and content data for lakes and reservoirs, water-quality data for surface water, and ground-water level data. The locations of the stations and wells where the data were collected are shown in figures 4-10. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

Station Identification Numbers

Each data station, whether streamsite or well, in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given station and to no other. The number usually is assigned when a station is first established and is retained for that station indefinitely. The systems used by the U.S. Geological Survey to assign identification numbers for surface-water stations and for ground-water well sites differ, but both are based on geographic location. The "downstream order" system is used for all surface-water stations except some lakes and the "latitude-longitude" system is used for wells and lakes.

Downstream Order System

Since October 1, 1950, the order of listing hydrologic-station records in Survey reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a mainstream station are listed before that station. A station on a tributary that enters between two mainstream stations is listed between them. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary with respect to the stream to which it is immediately tributary is indicated by an indention in the "List of Stations" in the front of this report. Each indention represents one rank. This downstream order and system of indention shows which stations are on tributaries between any two stations and the rank of the tributary on which each station is situated.

The station-identification number is assigned according to downstream order. In assigning station numbers, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list made up of both types of stations. Gaps are left in the series of numbers to allow for new stations that may be established; hence, the numbers are not consecutive. The complete eight-digit number for each station, such as 04037500, which appears just to the left of the station name, includes the two-digit Part number "04" plus the six-digit downstream-order number "037500." The Part number designates the major river basin; for example, Part "04" is the St. Lawrence River basin.

Latitude-Longitude System

The identification numbers for wells are assigned according to the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude, the next seven digits denote degrees, minutes, and seconds of longitude, and the last two digits (assigned sequentially) identify the wells or other sites within a 1-second grid. This site-identification number, once assigned, is a pure number and has no locational significance. In the rare instance where the initial determination of latitude and longitude are found to be in error, the station will retain its initial identification number; however, its true latitude and longitude will be listed in the LOCATION paragraph of the station description. (See figure 2.)

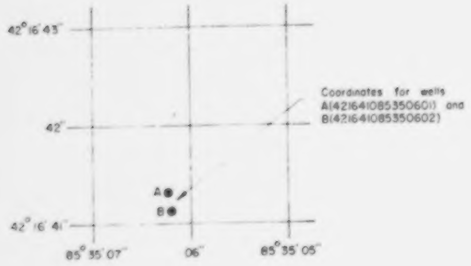

Figure 2. System for numbering wells (latitude and longitude).

Local Well Numbering System

The local well number indicates the location of wells within the rectangular subdivision of land with reference to the Michigan meridian and base line. The first two segments of the well number designate township and range, the third segment of the number designates the section and the letters A through D designate successively smaller subdivisions of the section as shown in figure 3. Thus, a well designated as 32N 6E 16CCCB would be located to the nearest 2.5 acres and would be within the shaded area in section 16. In the event that two or more wells are located in the same 2.5 acre tract, a sequential number designation follows the letter designations--for example, 16CCCB1, 16CCCB2, 16CCCB3, etc.

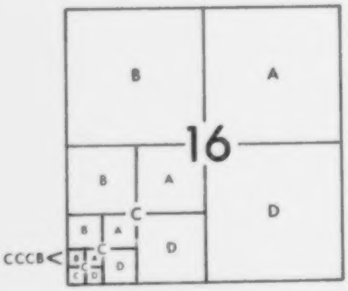

Figure 3. Local well numbering system in Michigan.

Records of Stage and Water Discharge

Records of stage and water discharge may be complete or partial. Complete records of discharge are those obtained using a continuous stage-recording device through which either instantaneous or mean daily discharges may be computed for anytime, or any period of time, during the period of record. Complete records of lake or reservoir content, similarly, are those for which stage or content may be computed or estimated with reasonable accuracy for any time, or period of time. They may be obtained using a continuous stage-recording device, but need not be. Because daily mean discharges and end-of-month contents commonly are published for such stations, they are referred to as "daily stations."

By contrast, partial records are obtained through discrete measurements without using a continuous stage-recording device and pertain only to a few flow characteristics, or perhaps only one. The nature of the partial record is indicated by table titles such as "Crest-stage partial records," or "Low-flow partial records." Records of miscellaneous discharge measurements or of measurements from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. Location of all complete-record water-discharge stations for which data are given in this report are shown in figures 4 and 5.

Data Collection and Computation

The data obtained at a complete-record gaging station on a stream or canal consist of a continuous record of stage, individual measurements of discharge throughout a range of stages, and notations regarding factors that may affect the relationships between stage and discharge. These data, together with supplemental information, such as weather records, are used to compute daily discharges. The data obtained at a complete-record gaging station on a lake or reservoir consist of a record of stage and of notations regarding factors that may affect the relationship between stage and lake content. These data are used with stage-area and stage-capacity curves or tables to compute water-surface areas and lake storage.

Continuous records of stage are obtained with analog recorders that trace continuous graphs of stage or with digital recorders that punch stage values on paper tapes at selected time intervals. Measurements of discharge are made with current meters using methods adopted by the Geological Survey as a result of experience accumulated since 1880. These methods are described in standard textbooks, in Water-Supply Paper 2175, and in U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A6.

In computing discharge records, results of individual measurements are plotted against the corresponding stages, and stage-discharge relation curves are then constructed. From these curves, rating tables indicating the approximate discharge for any stage within the range of the measurements are prepared. If it is necessary to define extremes of discharge outside the range of the current-meter measurements, the curves are extended using: (1) logarithmic plotting; (2) velocity-area studies; (3) results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computations of flow over dams or weirs; or (4) step-backwater techniques.

Daily mean discharges are computed by applying the daily mean stages (gage heights) to the stage-discharge curves or tables. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on the individual discharge measurements and notes of the personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic growth or debris on the control. For some stations, formation of ice in the winter may so obscure the stage-discharge relations that daily mean discharges must be estimated from other information such as temperature and precipitation records, notes of observations, and records for other stations in the same or nearby basins for comparable periods.

At some stream-gaging stations, the stage-discharge relation is affected by the backwater from reservoirs, tributary streams, or other sources. This necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in computing discharge. The slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage; at these stations the rate of change in stage is used as a factor in computing discharge.

In computing records of lake or reservoir contents, it is necessary to have available from surveys, curves or tables defining the relationship of stage and content. The application of stage to the stage-content curves or tables gives the contents from which daily, monthly, or yearly changes then are determined. If the stage-content relationship changes because of deposition of sediment in a lake or reservoir, periodic resurveys may be necessary to redefine the relationship. Even when this is done, the contents computed may become increasingly in error as the lapsed time since the last survey increases. Discharges over lake or reservoir spillways are computed from stage-discharge relationships much as other stream discharges are computed.

For some gaging stations, there are periods when no gage-height record is obtained, or the recorded gage height is so faulty that it cannot be used to compute daily discharge or contents. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, or for various other reasons. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise, daily contents may be estimated from operator's logs, previous or following record, inflow-outflow studies, and other information. Information explaining how estimated daily-discharge values are identified in station records is included in the next two sections, "Data Presentation" (REMARKS paragraph) and "Identifying Estimated Daily Discharge."

Data Presentation

The records published for each gaging station consist of two parts, the manuscript or station description and the data table for the current water year. The manuscript provides, under various headings, descriptive information, such as station location; period of record; average discharge; historical extremes; record accuracy; and other remarks pertinent to station operation and regulation. The following information, as appropriate, is provided with each continuous record of discharge or lake content. Comments to follow clarify information presented under the various headings of the station description.

LOCATION.--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement, "Bulletin 14, Revision of October 1968, prepared by the Water Resources Council or were provided by the U.S. Army Corps of Engineers.

DRAINAGE AREA.--Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

PERIOD OF RECORD.--This indicates the period for which there are published records for the station or for an equivalent station. An equivalent station is one that was in operation at a time that the present station was not, and whose location was such that records from it can reasonably be considered equivalent with records from the present station.

REVISED RECORDS.--Published records, because of new information, occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all the reports in which revisions have been published for the station and the water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year dates as follows: "(M)" means that only the instantaneous maximum discharge was revised; "(m)" that only the instantaneous minimum was revised; and "(P)" that only peak discharges were revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

GAGE.--The type of gage in current use, the datum of the current gage referred to National Geodetic Vertical Datum of 1929 (see glossary), and a condensed history of the types, locations, and datums of previous gages are given under this heading.

REMARKS.--All periods of estimated daily-discharge record will either be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily-discharge table. (See next section, "Identifying Estimated Daily Discharge.") If a remarks statement is used to identify estimated record, the paragraph will begin with this information presented as the first entry. The paragraph is also used to present information relative to the accuracy of the records, to special methods of computation, to conditions that affect natural flow at the station and, possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose and use of the reservoir.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

AVERAGE DISCHARGE.--The discharge value given is the arithmetic mean of the water-year mean discharges. It is computed only for stations having at least 5 water years of complete record, and only water years of complete record are included in the computation. It is not computed for stations where diversions, storage, or other water-use practices cause the value to be meaningless. If water developments significantly altering flow at a station are put into use after the station has been in operation for a period of years, a new average is computed as soon as 5 water years of record have accumulated following the development.

EXTREMES FOR PERIOD OF RECORD.--Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest-stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the same manner as the maximum.

EXTREMES OUTSIDE PERIOD OF RECORD.--Included here is information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the U.S. Geological Survey.

EXTREMES FOR CURRENT YEAR.--Extremes given here are similar to those for the period of record, except the peak discharge listing may include secondary peaks. For stations meeting certain criteria, all peak discharges and stages occurring during the water year and greater than a selected base discharge are presented under this heading. The peaks greater than the base discharge, excluding the highest one, are referred to as secondary peaks. Peak discharges are not published for canals, ditches, drains, or streams for which the peaks are subject to substantial control by man. The time of occurrence for peaks is expressed in 24-hour local standard time. For example, 12:30 a.m. is 0030, and 1:30 p.m. is 1330. The minimum for the current water year appears below the table of peak data.

REVISIONS.--If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because, for these stations, there would be no current or, possibly, future station manuscript published to document the revision in a "Revised Records" entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the offices whose addresses are given on the back of the title page of this report to determine if the published records were ever revised after the station was discontinued. Of course, if the data were obtained by computer retrieval, the data would be current and there would be no need to check because any published revision of data is always accompanied by revision of the corresponding data in computer storage.

Manuscript information for lake or reservoir stations differs from that for stream stations in the nature of the "Remarks" and in the inclusion of a skeleton stage-capacity table when daily contents are given.

The daily table for stream-gaging stations gives mean discharge for each day and is followed by monthly and yearly summaries. In the monthly summary below the daily table, the line headed "TOTAL" gives the sum of the daily figures. The line headed "MEAN" gives the average flow in cubic feet per second during the month. The lines headed "MAX" and "MIN" give the maximum and minimum daily discharges, respectively, for the month. Discharge for the month also is usually expressed in cubic feet per second per square mile (line headed "CFSM"), or in inches (line headed "IN."), or in acre-feet (line headed "AC-FT"). Figures for cubic feet per second per square mile and runoff in inches are omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. In the yearly summary below the monthly summary, the figures shown are the appropriate discharges for the calendar and water years. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversions or reservoir contents are given. These figures are identified by a symbol and corresponding footnote.

Data collected at partial-record stations follow the information for continuous-record sites. Data for partial-record discharge stations are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage partial-record stations, and the second is a table of discharge measurements at low-flow partial-record stations. The tables of partial-record stations are followed by a listing of discharge measurements made at sites other than continuous-record or partial-record stations. These measurements are generally made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified either by flagging individual daily values with the letter symbol "e" and printing a table footnote, "e Estimated," or by listing the dates of the estimated record in the REMARKS paragraph of the station description.

Accuracy of the Records

The accuracy of streamflow records depends primarily on: (1) The stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of measurements of stage, measurements of discharge, and interpretation of records.

The accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within 5 percent of their true values; "good," within 10 percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned are rated "poor." Different accuracies may be attributed to different parts of a given record.

Daily mean discharges in this report are given to the nearest hundredth of a cubic foot per second for values less than 1 ft^3/s; to the nearest tenth between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to 3 significant figures for more than 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, figures of cubic feet per second per square mile and of runoff, in inches, are not published unless satisfactory adjustments can be made for diversions, for changes in contents of reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may occur if adjustments or losses are large in comparison with the observed discharge.

Other Records Available

Information used in the preparation of the records in this publication, such as discharge-measurement notes, gage-height records, temperature measurements, and rating tables are on file in the Michigan District Office. Also, most of the daily mean discharges are in computer-readable form and have been analyzed statistically. Information on the availability of the unpublished information or on the results of statistical analyses of the published records may be obtained from the Michigan District Office.

Records of Surface-Water Quality

Records of surface-water quality ordinarily are obtained at or near stream-gaging stations because interpretation of records of surface-water quality nearly always requires corresponding discharge data. Records of surface-water quality in this report may involve a variety of types of data and measurement frequencies.

Classification of Records

Water-quality data for surface-water sites are grouped into one of three classifications. A continuing-record station is a site where data are collected on a regularly scheduled basis. Frequency may be once or more times daily, weekly, monthly, or quarterly. A partial-record station is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A miscellaneous sampling site is a location other than a continuing or partial-record station where random samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between "continuing records" , as used in this report, and "continuous recordings," which refers to a continuous graph or a series of discrete values punched at short intervals on a paper tape. Some records of water quality, such as temperature and specific conductance, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. Locations of stations for which records on the quality of surface water appear in this report are shown in figures 6-7.

Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence. Water-quality data for miscellaneous sampling sites appear in a separate table following the table of discharge measurements at miscellaneous sites.

On-site Measurements and Sample Collection

In obtaining water-quality data, a major concern needs to be assuring that the data obtained represent the in situ quality of the water. To assure this, certain measurements, such as water temperature, pH, and dissolved oxygen, need to be made on site when the samples are taken. To assure that measurements made in the laboratory also represent the in situ water, carefully prescribed procedures need to be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory. Procedures for on site measurements and for collecting, treating, and shipping samples are given in publications on "Techniques of Water-Resources Investigations," Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4. All of these references are listed under "PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS" which appears at the end of the introductory text. Also, detailed information on collecting, treating, and shipping samples may be obtained from the Geological Survey Michigan District Office.

One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream. Some streams must be sampled through several vertical sections to obtain a representative sample needed for an accurate mean concentration and for use in calculating load. Many samples obtained for the National Stream Quality Accounting Network (see definitions) are obtained from at least several verticals. Whether samples are obtained from the centroid of flow or from several verticals depends on flow conditions and other factors which must be evaluated by the collector.

Chemical-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis.

For chemical-quality stations equipped with digital monitors, the records consist of daily maximum, minimum, and mean values for each constituent measured and are based upon hourly punches beginning at 0100 hours and ending at 2400 hours for the day of record. More detailed records (hourly values) may be obtained from the Geological Survey Michigan District Office whose address is given on the back of the title page of this report.

Water Temperature

Water temperatures are measured at all the water-quality stations. In addition, water temperatures are taken at time of discharge measurements for water-discharge stations. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges.

At stations where recording instruments are used, either mean temperatures and/or maximum and minimum temperatures for each day are published. Water temperatures measured at the time of water-discharge measurements are on file in the Michigan District Office.

Sediment

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross section.

At some stations, suspended-sediment samples were collected periodically at many verticals in the stream cross section. Although data collected periodically may represent conditions only at the time of observations, such data are useful in establishing seasonal relations between quality and streamflow and in predicting long-term sediment-discharge characteristics of the stream.

Laboratory Measurements

Sediment samples were analyzed in the Geological Survey laboratory in Harrisburg, Pennsylvania. All other samples were analyzed in the Geological Survey laboratories in Arvada, Colorado. Methods used in analyzing sediment samples and computing sediment records are given in TWRI, Book 5, Chap. C1. Methods used by the Geological Survey laboratories are given in TWRI, Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4.

Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, cooperation, and extremes for parameters currently measured daily. Tables of chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance and water temperature then follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge gaging station, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information, as appropriate, is provided with each continuous-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

DRAINAGE AREA.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

PERIOD OF RECORD.--This indicates the periods for which there are published water-quality records for the station. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of record are given for the parameters individually.

INSTRUMENTATION.--Information is given only if a water-quality monitor or temperature recorder is or was in operation at a station.

REMARKS.--Remarks provide added information pertinent to the collection, analysis, or computation of the records.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

EXTREMES.--Maximums and minimums are given only for parameters measured daily or more frequently. None are given for parameters measured weekly or less frequently, because the true maximums or minimums may not have been sampled. Extremes, when given, are provided for both the period of record and for the current water year.

REVISIONS.--If errors in published water-quality records are discovered after publication, appropriate updates are made to the Water-Quality File in the U.S. Geological Survey's computerized data system, WATSTORE, and subsequently by monthly transfer of update transactions to the U.S. Environmental Protection Agency's STORET system. Because the usual volume of updates makes it impractical to document individual changes in the State data-report series or elsewhere, potential users of U.S. Geological Survey water-quality data are encouraged to obtain all required data from the appropriate computer file to insure the most recent updates.

The surface-water quality records for miscellaneous sampling sites are published in a separate table following the table of discharge measurements at miscellaneous sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular downstream-order sequence.

Remark Codes

The following remark codes may appear with the water-quality data in this report:

PRINTED OUTPUT	REMARK
E	Estimated value
>	Actual value is known to be greater than the value shown
<	Actual value is known to be less than the value shown
K	Results based on colony count outside the acceptance range (non-ideal colony count)
L	Biological organism count less than 0.5 percent (organism may be observed) rather than counted
D	Biological organism count equal to or greater than 15 percent (dominant)
&	Biological organism estimated as dominant

Records of Ground-Water Levels

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water-level changes in the Nation's most important aquifers. Locations of the observation wells in this network in Michigan are shown in figure 10.

Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well ensure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The prime identification number for a given well is the 15-digit number that appears in the upper left corner of the table. The secondary identification number is the local well number, an alphanumeric number, derived from the township-range location of the well.

Water-level records are obtained from direct measurements with a steel tape or from the graph or punched tape of a water-stage recorder. The water-level measurements in this report are given in feet with reference to land-surface datum (lsd). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the elevation of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month (eom).

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error of determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given to a tenth of a foot or a larger unit.

Data Presentation

Each well record consists of two parts, the station description and the data table of water levels observed during the water year. The description of the well is presented first through use of descriptive headings preceding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION.--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

AQUIFER.--This entry designates by name (if a name exists) and geologic age the aquifer(s) open to the well.

WELL CHARACTERISTICS.--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval, method of construction, use, and additional information such as casing breaks, collapsed screen, and other changes since construction.

INSTRUMENTATION.--This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on weekly, monthly, or some other frequency of measurement.

DATUM.--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in top of casing, plug in pump base and so on), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) National Geodetic Vertical Datum of 1929 (NGVD of 1929); it is reported with a precision depending on the method of determination.

REMARKS.--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that also are water-quality observation wells, and may be used to acknowledge the assistance of local (non-Survey) observers.

PERIOD OF RECORD.--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of publication of water-level records by the U.S. Geological Survey and the words "to current year" if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the Geological Survey, may be noted.

EXTREMES FOR PERIOD OF RECORD.--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence.

A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum and all taped measurements of water level are listed. For wells equipped with recorders, only abbreviated tables are published; generally, only water-level lows are listed for every fifth day and at the end of the month (eom). The highest and lowest water levels of the water year and their dates of occurrence are shown on a line below the abbreviated table. Because all values are not published for wells with recorders, the extremes may be values that are not listed in the table. Missing records are indicated by dashes in place of the water level.

ACCESS TO WATSTORE DATA

The National WATer Data STOrage and REtrieval System (WATSTORE) was established for handling water data collected through the activities of the U.S. Geological Survey and to provide for more effective and efficient means of releasing the data to the public. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Virginia.

WATSTORE can provide a variety of useful products ranging from simple data tables to complex statistical analyses. A minimal fee, plus the actual computer cost incurred in producing a desired product, is charged to the requester. Information about the availability of specific types of data, the acquisition of data or products, and user charges can be obtained locally from the Michigan District Office.

General inquiries about WATSTORE may be directed to:

Chief Hydrologist
U.S. Geological Survey
409 National Center
12201 Sunrise Valley Drive
Reston, Virginia 22092

DEFINITION OF TERMS

Terms related to streamflow, water-quality, and other hydrologic data, as used in this report, are defined below. See also table for converting English units to International System (SI) Units on the inside of the back cover.

Acre-foot (AC-FT, acre-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Adenosine triphosphate (ATP) is an organic, phosphate-rich, compound important in the transfer of energy in organisms. Its central role in living cells makes it an excellent indicator of the presence of living material in water. A measure of ATP therefore provides a sensitive and rapid estimate of biomass. ATP is reported in micrograms per liter of the original water sample.

Algae are mostly aquatic single-celled, colonial, or multi-celled plants, containing chlorophyll and lacking roots, stems, and leaves.

Algal growth potential (AGP) is the maximum algal dry weight biomass that can be produced in a natural water sample under standardized laboratory conditions. The growth potential is the algal biomass present at stationary phase and is expressed as milligrams dry weight of algae produced per liter of sample.

Aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian means confined and is used to describe a well in which the water level stands above the top of the aquifer tapped by the well. A flowing artesian well is one in which the water level is above the land surface.

Bacteria are microscopic unicellular organisms, typically spherical, rodlike, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, while others perform an essential role in nature in the recycling of materials; for example, by decomposing organic matter into a form available for reuse by plants.

Total coliform bacteria are a particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. In the laboratory these bacteria are defined as all the organisms that produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35°C plus or minus 1.0°C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal coliform bacteria are bacteria that are present in the intestine or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory they are defined as all organisms that produce blue colonies within 24 hours when incubated at 44.5°C plus or minus 0.2°C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal streptococcal bacteria are bacteria found also in the intestine of warm-blooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as Gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms which produce red or pink colonies within 48 hours at 35°C plus or minus 1.0°C on KF-streptococcus medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Bed material is the sediment mixture of which a streambed, lake, pond, reservoir, or estuary bottom is composed.

Biochemical oxygen demand (BOD) is a measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by micro-organisms, such as bacteria.

Biomass is the amount of living matter present at any given time, expressed as the mass per unit area or volume of habitat.

Ash mass is the mass or amount of residue present after the residue from the dry mass determination has been ashed in a muffle furnace at a temperature of 500°C for 1 hour. The ash mass values of zooplankton and phytoplankton are expressed in grams per cubic meter (g/m^3), and periphyton and benthic organisms in grams per square meter (g/m^2).

Dry mass refers to the mass of residue present after drying in an oven at 105°C for zooplankton and periphyton, until the mass remains unchanged. This mass represents the total organic matter, ash and sediment, in the sample. Dry-mass values are expressed in the same units as ash mass.

Organic mass or volatile mass of the living substance is the difference between the dry mass and ash mass and represents the actual mass of the living matter. The organic mass is expressed in the same units as for ash mass and dry mass.

Wet mass is the mass of living matter plus contained water.

Bottom material: See Bed material.

Cells/volume refers to the number of cells of any organism which is counted by using a microscope and grid or counting cell. Many planktonic organisms are multicelled and are counted according to the number of contained cells per sample, usually milliliters (mL) or liters (L).

Chemical oxygen demand (COD) is a measure of the chemically oxidizable material in the water and furnishes an approximation of the amount of organic and reducing material present. The determined value may correlate with natural water color or with carbonaceous organic pollution from sewage or industrial wastes.

Chlorophyll refers to the green pigments of plants. Chlorophyll a and b are the two most common green pigments in plants.

Color unit is produced by one milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

Contents is the volume of water in a reservoir or lake. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, an artificial structure, or a uniform cross section over a long reach of the channel.

Control structure as used in this report is a structure on a stream or canal that is used to regulate the flow or stage of the stream or to prevent the intrusion of salt water.

Cubic feet per second per square mile (CFSM) is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Cubic foot per second (ft^3/s) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meters per second.

Cubic foot per second-day [$(ft^3/s)/d$] is the volume of water represented by a flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, approximately 1.9835 acre-feet, about 646,000 gallons, or 2,445 cubic meters.

Discharge is the volume of water (or more broadly, volume of fluid plus suspended sediment) that passes a given point within a given period of time.

Mean discharge (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period.

Instantaneous discharge is the discharge at a particular instant of time.

Dissolved refers to that material in a representative water sample which passes through a 0.45 um membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of "dissolved" constituents are made on subsamples of the filtrate.

Dissolved-solids concentration of water is determined either analytically by the "residue-on-evaporation" method, or mathematically by totaling the concentrations of individual constituents reported in a comprehensive chemical analysis. During the analytical determination of dissolved solids, the bicarbonate (generally a major dissolved component of water) is converted to carbonate. Therefore, in the mathematical calculation of dissolved-solids concentration, the bicarbonate value, in milligrams per liter, is multiplied by 0.492 to reflect the change.

Drainage area of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise specified.

Drainage basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Gage height (G.H.) is the water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Hardness of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather. It is computed as the sum of equivalents of polyvalent cations and is expressed as the equivalent concentration of calcium carbonate ($CaCO_3$).

Hydrologic Bench-Mark Network is a network of 58 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

Hydrologic unit is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the Office of Water Data Coordination on the State Hydrologic Unit Maps; each hydrologic unit is identified by an eight-digit number.

Land-surface datum (lsd) is a datum plane that is approximately at land surface at each ground-water observation well.

Measuring point (MP) is an arbitrary permanent reference point from which the distance to the water surface in a well is measured to obtain the water level.

Metamorphic stage refers to the stage of development that an organism exhibits during its transformation from an immature form to an adult form. This developmental process exists for most insects, and the degree of difference from the immature stage to the adult form varies from relatively slight to pronounced, with many intermediates. Examples of metamorphic stages of insects are egg-larva-adult or egg-nymph-adult.

Methylene blue active substances (MBAS) are apparent detergents. The determination depends on the formation of a blue color when methylene blue dye reacts with synthetic anionic detergent compounds.

Micrograms per gram (ug/g) is a unit expressing the concentration of a chemical constituent as the mass (micrograms) of the element per unit mass (gram) of material analyzed.

Micrograms per liter (UG/L, ug/L) is a unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Milligrams per liter (MG/L, mg/L) is a unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the mass of solute per unit volume (liter) of water. Concentration of suspended sediment also is expressed in mg/L and is based on the mass of dry sediment per liter of water-sediment mixture.

National Geodetic Vertical Datum of 1929 (NGVD of 1929) is a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

National Stream Quality Accounting Network (NASQAN) is a nationwide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water-quality assessment and hydrologic research.

Organism is any living entity.

Organism count/area refers to the number of organisms collected and enumerated in a sample and adjusted to the number per area habitat, usually square meter (m^2), acre, or hectare. Periphyton, benthic organisms, and macrophytes are expressed in these terms.

Organism count/volume refers to the number of organisms collected and enumerated in a sample and adjusted to the number per sample volume, usually milliliter (mL) or liter (L). Numbers of planktonic organisms can be expressed in these terms.

Total organism count is the total number of organisms collected and enumerated in any particular sample.

Parameter Code is a 5-digit number used in the U.S. Geological Survey computerized data system, WATSTORE, to uniquely identify a specific constituent. The codes used in WATSTORE are the same as those used in the U.S. Environmental Protection Agency data system, STORET. The Environmental Protection Agency assigns and approves all requests for new codes.

Partial-record station is a particular site where limited streamflow and/or water-quality data are collected systematically over a period of years for use in hydrologic analyses.

Particle size is the diameter, in millimeters (mm), of a particle determined by either sieve or sedimentation methods. Sedimentation methods (pipet, bottom-withdrawal tube, visual-accumulation tube) determine fall diameter of particles in either distilled water (chemically dispersed) or in native water (the river water at the time and point of sampling).

Particle-size classification used in this report agrees with the recommendation made by the American Geophysical Union Subcommittee on Sediment Terminology. The classification is as follows:

Classification	Size (mm)	Method of analysis
Clay..........	0.00024 - 0.004	Sedimentation
Silt..........	.004 - .062	Sedimentation
Sand..........	.062 - 2.0	Sedimentation or sieve
Gravel........	2.0 - 64.0	Sieve

The particle-size distributions given in this report are not necessarily representative of all particles in transport in the stream. Most of the organic matter is removed, and the sample is subjected to mechanical and chemical dispersion before analysis in distilled water. Chemical dispersion is not used for native-water analysis.

Percent composition is a unit for expressing the ratio of a particular part of a sample or population to the total sample or population, in terms of types, numbers, mass, or volume.

Periphyton is the assemblage of microorganisms attached to and living upon submerged solid surfaces. While primarily consisting of algae, they also include bacteria, fungi, protozoa, rotifers, and other small organisms.

Pesticides are chemical compounds used to control undesirable organisms. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides.

Picocurie (PC, pCi) is one trillionth (1×10^{-12}) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields 3.7×10^{10} radioactive disintegrations per second. A picocurie yields 2.22 dpm (disintegrations per minute).

Plankton is the community of suspended, floating, or weakly swimming organisms that live in the open water of lakes and rivers.

Phytoplankton is the plant part of the plankton. They are usually microscopic and their movement is subject to the water currents. Phytoplankton growth is dependent upon solar radiation and nutrient substances. Because they are able to incorporate as well as release materials to the surrounding water, the phytoplankton have a profound effect upon the quality of the water. They are the primary food producers in the aquatic environment and are commonly known as algae.

Blue-green algae are a group of phytoplankton organisms having a blue pigment, in addition to the green pigment called chlorophyll. Blue-green algae often cause nuisance conditions in water.

Diatoms are the unicellular or colonial algae having a siliceous shell. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample.

Green algae have chlorophyll pigments similar in color to those of higher green plants. Some forms produce algae mats or floating "moss" in lakes. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample.

Zooplankton is the animal part of the plankton. Zooplankton are capable of extensive movements within the water column and are often large enough to be seen with the unaided eye. Zooplankton are secondary consumers feeding upon bacteria, phytoplankton, and detritus. Because they are the grazers in the aquatic environment, the zooplankton are a vital part of the aquatic food web. The zooplankton community is dominated by small crustaceans and rotifers.

Polychlorinated biphenyls (PCBs) are industrial chemicals that are mixtures of chlorinated biphenyl compounds having various percentages of chlorine. They are similar in structure to organochlorine insecticides.

Primary productivity is a measure of the rate at which new organic matter is formed and accumulated through photosynthetic and chemosynthetic activity of producer organisms (chiefly, green plants). The rate of primary production is estimated by measuring the amount of oxygen released (oxygen method) or the amount of carbon assimilated by the plants (carbon method).

Milligrams of carbon per area or volume per unit time [mg C/(m^2.time)] for periphyton and macrophytes and [mg C/(m^3.time)] for phytoplankton are units for expressing primary productivity. They define the amount of carbon dioxide consumed as measured by radioactive carbon (carbon 14). The carbon 14 method is of greater sensitivity than the oxygen light and dark bottle method and is preferred for use in unenriched waters. Unit time may be either the hour or day, depending on the incubation period.

Milligrams of oxygen per area or volume per unit time [$mgO_2/(m^2.time)$] for periphyton and macrophytes and [$mgO_2/(m^3.time)$] for phytoplankton are the units for expressing primary productivity. They define production and respiration rates as estimated from changes in the measured dissolved-oxygen concentration. The oxygen light and dark bottle method is preferred if the rate of primary production is sufficient for accurate measurements to be made within 24 hours. Unit time may be either the hour or day, depending on the incubation period.

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

Recoverable from bottom material is the amount of a given constituent that is in solution after a representative sample of bottom material has been digested by a method (usually using an acid or mixture of acids) that results in dissolution of readily soluble substances. Complete dissolution of all bottom material is not achieved by the digestion treatment and thus the determination represents less than the total amount (that is, less than 95 percent) of the constituent in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Return period is the average time interval between occurrences of a hydrological event of a given or greater magnitude, usually expressed in years. May also be called recurrence interval.

Runoff in inches (IN., in.) shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Sediment is solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation.

Bed load is the sediment that is transported in a stream by rolling, sliding, or skipping along the bed and very close to it. In this report, bed load is considered to consist of particles in transit within 0.25 ft of the streambed.

Bed load discharge (tons per day) is the quantity of bed load measured by dry weight that moves past a section as bed load in a given time.

Suspended sediment is the sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended-sediment concentration is the velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture (mg/L).

Mean concentration is the time-weighted concentration of suspended sediment passing a stream section during a 24-hour day.

Suspended-sediment discharge (tons/day) is the rate at which dry mass of sediment passes a section of a stream or is the quantity of sediment, as measured by dry mass or volume, that passes a section in a given time. It is calculated in units of tons per day as follows: concentration (mg/L) x discharge (ft^3/s) x 0.0027.

Suspended-sediment load is a general term that refers to material in suspension. It is not synonymous with either discharge or concentration.

Total-sediment discharge (tons/day) is the sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry mass or volume, that passes a section during a given time.

Total-sediment load or total load is a term which refers to the total sediment (bed load plus suspended-sediment load) that is in transport. It is not synonymous with total-sediment discharge.

7-day 10-year low flow (7 Q 10) is the discharge at the 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days (the 7-day low flow).

Sodium-adsorption-ratio (SAR) is the expression of relative activity of sodium ions in exchange reactions within soil and is an index of sodium or alkali hazard to the soil. Waters range in respect to sodium hazard from those which can be used for irrigation on almost all soils to those which are generally unsatisfactory for irrigation.

Solute is any substance that is dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in microsiemens per centimeter at 25°C. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in microsiemens). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.

Stage-discharge relation is the relation between gage height (stage) and volume of water, per unit of time, flowing in a channel.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Substrate is the physical surface upon which an organism lives.

Natural substrate refers to any naturally occurring emersed or submersed solid surface, such as a rock or tree, upon which an organism lives.

Artificial substrate is a device which is purposely placed in a stream or lake for colonization of organisms. The artificial substrate simplifies the community structure by standardizing the substrate from which each sample is taken. Examples of artificial substrates are basket samplers (made of wire cages filled with clean streamside rocks) and multiplate samplers (made of hardboard) for benthic organism collection, and plexiglass strips for periphyton collection.

Surface area of a lake is that area outlined on the latest U.S.G.S. topographic map as the boundary of the lake and measured by a planimeter in acres. In localities not covered by topographic maps, the areas are computed from the best maps available at the time planimetered. All areas shown are those for the stage when the planimetered map was made.

Surficial bed material is the part (0.1 to 0.2 ft) of the bed material that is sampled using U.S. Series Bed-Material Samplers.

Suspended (as used in tables of chemical analyses) refers to the amount (concentration) of undissolved material in a water-sediment mixture. It is associated with the material retained on a 0.45-micrometer filter.

Suspended, recoverable is the amount of a given constituent that is in solution after the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all the particulate matter is not achieved by the digestion treatment and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Determinations of "suspended, recoverable" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total recoverable concentrations of the constituent.

Suspended, total is the total amount of a given constituent in the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total."

Determinations of "suspended, total" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total concentrations of the constituent.

Taxonomy is the division of biology concerned with the classification and naming of organisms. The classification of organisms is based upon a hierarchial scheme beginning with Kingdom and ending with Species at the base. The higher the classification level, the fewer features the organisms have in common. For example, the taxonomy of a particular mayfly, Hexagenia limbata, is the following:

Kingdom....................	Animal
Phylum.....................	Arthropoda
Class......................	Insecta
Order......................	Ephemeroptera
Family.....................	Ephemeridae
Genus......................	Hexagenia
Species....................	Hexagenia limbata

Thermograph is an instrument that continuously records variations of temperature on a chart. The more general term "temperature recorder" is used in the table headings and refers to any instrument that records temperature whether on a chart, a tape, or any other medium.

Time-weighted average is computed by multiplying the number of days in the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the total number of days. A time-weighted average represents the composition of water that would be contained in a vessel or reservoir that had received equal quantities of water from the stream each day for the year.

Tons per acre-foot indicates the dry mass of dissolved solids in 1 acre-foot of water. It is computed by multiplying the concentration of the constituent, in milligrams per liter, by 0.00136.

Tons per day (T/DAY) is the quantity of a substance in solution or suspension that passes a stream section during a 24-hour period.

Total is the total amount of a given constituent in a representative water-suspended sediment sample, regardless of the constituent's physical or chemical form. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent present in both the dissolved and suspended phases of the sample. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total." (Note that the word "total" does double duty here, indicating both that the sample consists of a water-suspended sediment mixture and that the analytical method determined all of the constituent in the sample.)

Total discharge is the total quantity of any individual constituent, as measured by dry mass or volume, that passes through a stream cross-section per unit of time. This term needs to be qualified, such as "total sediment discharge," "total chloride discharge," and so on.

Total, recoverable is the amount of a given constituent that is in solution after a representative water-suspended sediment sample has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all particulate matter is not achieved by the digestion treatment, and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the dissolved and suspended phases of the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Water year in Geological Survey reports dealing with surface-water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1988, is called the "1988 water year."

WDR is used as an abbreviation for "Water-Data Report" in the REVISED RECORDS paragraph to refer to State annual hydrologic-data reports (WRD was used as an abbreviation for "Water-Resources Data" in reports published prior to 1976).

Weighted average is used in this report to indicate discharge-weighted average. It is computed by multiplying the discharge for a sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. A discharge-weighted average approximates the composition of water that would be found in a reservoir containing all the water passing a given location during the water year after thorough mixing in the reservoir.

WSP is used as an abbreviaton for "Water-Supply Paper" in reference to previously published reports.

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S. Geological Survey publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section A of Book 3 (Applications of Hydraulics) pertains to surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be sent by check or money order payable to the U.S. Geological Survey. Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

1-D1. Water temperature--influential factors, field measurement, and data presentation, by H. H. Stevens, Jr., J. F. Ficke, and G. F. Smoot: USGS--TWRI Book 1, Chapter D1. 1975. 65 pages.

1-D2. Guidelines for collection and field analysis of ground-water samples for selected unstable constituents, by W. W. Wood: USGS--TWRI Book 1, Chapter D2. 1976. 24 pages.

2-D1. Application of surface geophysics to ground-water investigations, by A. A. R. Zohdy, G. P. Eaton, and D. R. Mabey: USGS--TWRI Book 2, Chapter D1. 1974. 116 pages.

2-E1. Application of borehole geophysics to water-resources investigations, by W. S. Keys and L. M. MacCary: USGS--TWRI Book 2, Chapter E1. 1971. 126 pages.

3-A1. General field and office procedures for indirect discharge measurements, by M. A. Benson and Tate Dalrymple: USGS--TWRI Book 3, Chapter A1. 1967. 30 pages.

3-A2. Measurement of peak discharge by the slope-area method, by Tate Dalrymple and M. A. Benson: USGS--TWRI Book 3, Chapter A2. 1967. 12 pages.

3-A3. Measurement of peak discharge at culverts by indirect methods, by G. L. Bodhaine: USGS--TWRI Book 3, Chapter A3. 1968. 60 pages.

3-A4. Measurement of peak discharge at width contractions by indirect methods, by H. J. Matthai: USGS--TWRI Book 3, Chapter A4. 1967. 44 pages.

3-A5. Measurement of peak discharge at dams by indirect methods, by Harry Hulsing: USGS--TWRI Book 3, Chapter A5. 1967. 29 pages.

3-A6. General procedure for gaging streams, by R. W. Carter and Jacob Davidian: USGS--TWRI Book 3, Chapter A6. 1968. 13 pages.

3-A7. Stage measurements at gaging stations, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3. Chapter A7. 1968. 28 pages.

3-A8. Discharge measurements at gaging stations, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A8. 1969. 65 pages.

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3-A10. Discharge ratings at gaging stations, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A10. 1984. 59 pages.

3-A11. Measurement of discharge by moving-boat method, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 3, Chapter A11. 1969. 22 pages.

3-A12. Fluorometric procedures for dye tracing, by J. F. Wilson, Jr., E. D. Cobb, and F. A. Kilpatrick: USGS--TWRI Book 3, Chapter A12. 1986. 41 pages.

3-A13. Computation of continuous records of streamflow, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A13. 1983. 53 pages.

3-A14. Use of flumes in measuring discharge, by F. A. Kilpatrick and V. R. Schneider: USGS--TWRI Book 3, Chapter A14. 1983. 46 pages.

3-A15. Computation of water-surface profiles in open channels, by Jacob Davidian: USGS--TWRI Book 3, Chapter A15. 1984. 48 pages.

3-A16. Measurement of discharge using tracers, by F. A. Kilpatrick and E. D. Cobb: USGS--TWRI Book 3, Chapter A16. 1985. 52 pages.

3-A17. Acoustic velocity meter systems, by Antonius Laenen: USGS--TWRI Book 3, Chapter A17. 1985. 38 pages.

3-B1. Aquifer-test design, observation, and data analysis, by R. W. Stallman: USGS--TWRI Book 3, Chapter B1. 1971. 26 pages.

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3-B2. Introduction to ground-water hydraulics, a programed test for self-instruction, by G. D. Bennett: USGS--TWRI Book 3, Chapter B2. 1976. 172 pages.

3-B3. Type curves for selected problems of flow to wells in confined aquifers, by J. E. Reed: USGS--TWRI Book 3, Chapter B3. 1980. 106 pages.

3-B5. Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems--An introduction, by O. L. Franke, T. E. Reilly, and G. D. Bennett: USGS--TWRI Book 3, Chapter B5. 1987. 15 pages.

3-B6. The principle of superposition and its application in ground-water hydraulics, by T. E. Reilly, O. L. Franke, and G. D. Bennett: USGS--TWRI Book 3, Chapter B6. 1987. 28 pages.

3-C1. Fluvial sediment concepts, by H. P. Guy: USGS--TWRI Book 3, Chapter C1. 1970. 55 pages.

3-C2. Field methods for measurement of fluvial sediment, by H. P. Guy and V. W. Norman: USGS--TWRI Book 3, Chapter C2. 1970. 59 pages.

3-C3. Computation of fluvial-sediment discharge, by George Porterfield: USGS--TWRI Book 3, Chapter C3. 1972. 66 pages.

4-A1. Some statistical tools in hydrology, by H. C. Riggs: USGS--TWRI Book 4, Chapter A1. 1968. 39 pages.

4-A2. Frequency curves, by H. C. Riggs: USGS--TWRI Book 4, Chapter A2. 1968. 15 pages.

4-B1. Low-flow investigations, by H. C. Riggs: USGS--TWRI Book 4, Chapter B1. 1972. 18 pages.

4-B2. Storage analyses for water supply, by H. C. Riggs and C. H. Hardison: USGS--TWRI Book 4, Chapter B2. 1973. 20 pages.

4-B3. Regional analyses of streamflow characteristics, by H. C. Riggs: USGS--TWRI Book 4, Chapter B3. 1973. 15 pages.

4-D1. Computation of rate and volume of stream depletion by wells, by C. T. Jenkins: USGS-TWRI Book 4, Chapter D1. 1970. 17 pages.

5-A1. Methods for determination of inorganic substances in water and fluvial sediments, by M. W. Skougstad and others, editors: USGS--TWRI Book 5, Chapter A1. 1979. 626 pages.

5-A2. Determination of minor elements in water by emission spectroscopy, by P. R. Barnett and E. C. Mallory, Jr.: USGS--TWRI Book 5, Chapter A2. 1971. 31 pages.

5-A3. Methods for analysis of organic substances in water, by D. F. Goerlitz and Eugene Brown: USGS--TWRI Book 5, Chapter A3. 1972. 40 pages.

5-A4. Methods for collection and analysis of aquatic biological and microbiological samples, edited by P. E. Greeson, T. A. Ehlke, G. A. Irwin, B. W. Lium, and K. V. Slack: USGS--TWRI Book 5, Chapter A4. 1977. 332 pages.

5-A5. Methods for determination of radioactive substances in water and fluvial sediments, by L. L. Thatcher, V. J. Janzer, and K. W. Edwards: USGS--TWRI Book 5, Chapter A5. 1977. 95 pages.

5-A6. Quality assurance practices for the chemical and biological analyses of water and fluvial sediments, by L. C. Friedman and D. E. Erdmann: USGS--TWRI Book 5, Chapter A6. 1982. 181 pages.

5-C1. Laboratory theory and methods for sediment analysis, by H. P. Guy: USGS--TWRI Book 5, Chapter C1. 1969. 58 pages.

6-A1. A modular three-dimensional finite-difference ground-water flow model, by M. G. McDonald and A. W. Harbaugh: USGS--TWRI Book 6, Chapter A1. 1988. 586 pages.

7-C1. Finite difference model for aquifer simulation in two dimensions with results of numerical experiments, by P. C. Trescott, G. F. Pinder, and S. P. Larson: USGS--TWRI Book 7, Chapter C1. 1976. 116 pages.

7-C2. Computer model of two-dimensional solute transport and dispersion in ground water, by L. F. Konikow and J. D. Bredehoeft: USGS--TWRI Book 7, Chapter C2. 1978. 90 pages.

7-C3. A model for simulation of flow in singular and interconnected channels, by R. W. Schaffranek, R. A. Baltzer, and D. E. Goldberg. USGS--TWRI Book 7, Chapter C3. 1981. 110 pages.

8-A1. Methods of measuring water levels in deep wells, by M. S. Garber and F. C. Koopman: USGS--TWRI Book 8, Chapter A1. 1968. 23 pages.

8-A2. Installation and service manual for U.S. Geological Survey manometers, by J. D. Craig: USGS--TWRI Book 8, Chapter A2. 1983. 57 pages.

8-B2. Calibration and maintenance of vertical-axis type current meters, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 8, Chapter B2. 1968. 15 pages.

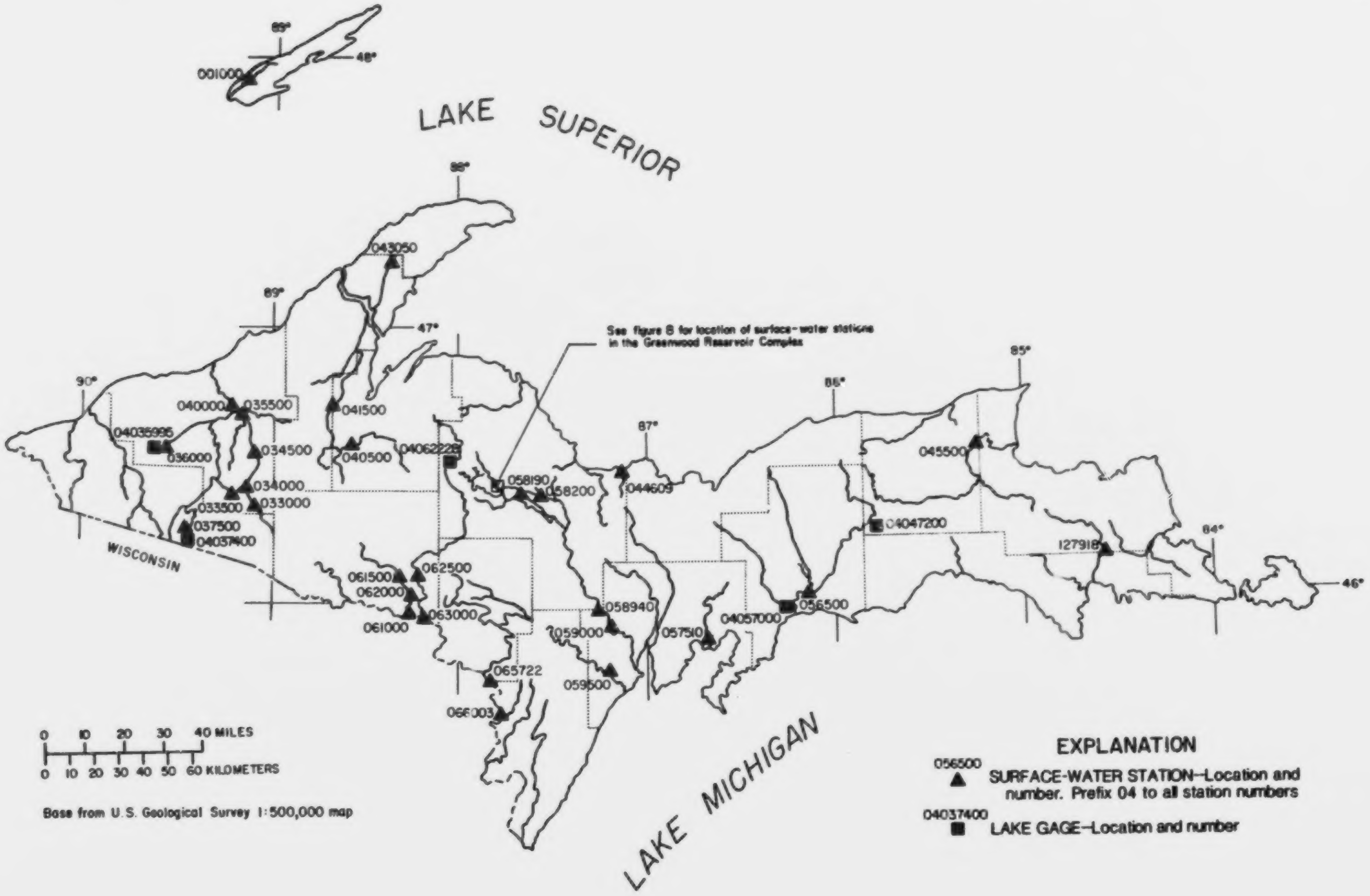

89°
48°
001000
LAKE SUPERIOR
88°
043050
89°
47°
See figure 8 for location of surface-water stations in the Greenwood Reservoir Complex
85°
86°
90°
040000
035500
041500
04035995
036000
034500
040500
04062226
87°
058190
058200
044609
045500
034000
033500
033000
037500
04037400
04047200
84°
127918
WISCONSIN
061500
062500
062000
061000
063000
058940
059000
057510
04057000
056500
46°
065722
059600
066003
0 10 20 30 40 MILES
0 10 20 30 40 50 60 KILOMETERS
Base from U.S. Geological Survey 1:500,000 map
LAKE MICHIGAN
EXPLANATION
056500 ▲ SURFACE-WATER STATION--Location and number. Prefix 04 to all station numbers
04037400 ■ LAKE GAGE--Location and number

Figure 4.--Identification number and location of active surface-water gaging stations in the Upper Peninsula of Michigan.

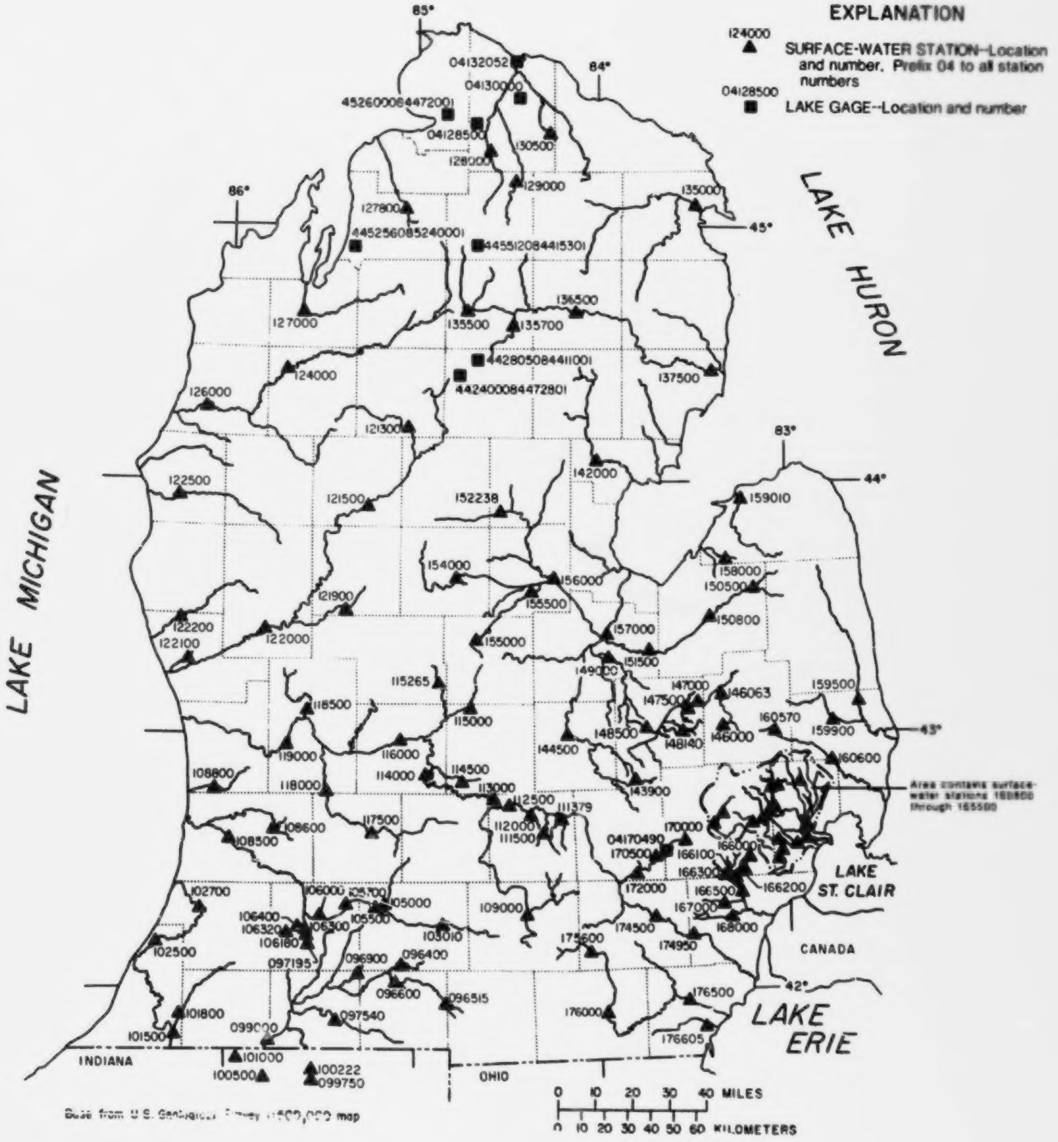

EXPLANATION
124000
SURFACE-WATER STATION--Location and number. Prefix 04 to all station numbers
04128500
LAKE GAGE--Location and number
85°
84°
86°
83°
45°
44°
43°
42°
LAKE HURON
LAKE MICHIGAN
LAKE ST. CLAIR
LAKE ERIE
CANADA
INDIANA
OHIO
04132052
04130000
452600084472001
04128500
130500
128000
129000
127800
135000
445256085240001
445512084415301
127000
135500
135700
136500
442805084411001
442400084472801
124000
126000
137500
121300
142000
122500
121500
152238
159010
154000
156000
155500
158000
150500
150800
121900
122200
122100
122000
155000
157000
151500
149000
115265
147000
147500
146063
159500
118500
115000
148500
148140
146000
160570
159900
144500
119000
116000
160600
108800
114000
114500
118000
113000
112500
111379
143900
Area contains surface-water stations 160800 through 165500
117500
108600
108500
112000
111500
04170490
170000
170500
166000
166100
166300
166200
172000
166500
102700
106000
105700
105000
109000
106400
106320
106300
105500
106180
103010
167000
168000
174500
175600
174950
102500
097195
096900
096400
096600
096515
176500
101800
097540
176000
101500
099000
176605
101000
100500
100222
099750
0 10 20 30 40 MILES
0 10 20 30 40 50 60 KILOMETERS
Base from U.S. Geological Survey 1:500,000 map

Figure 5.--Identification number and location of active surface-water gaging stations in the Lower Peninsula of Michigan.

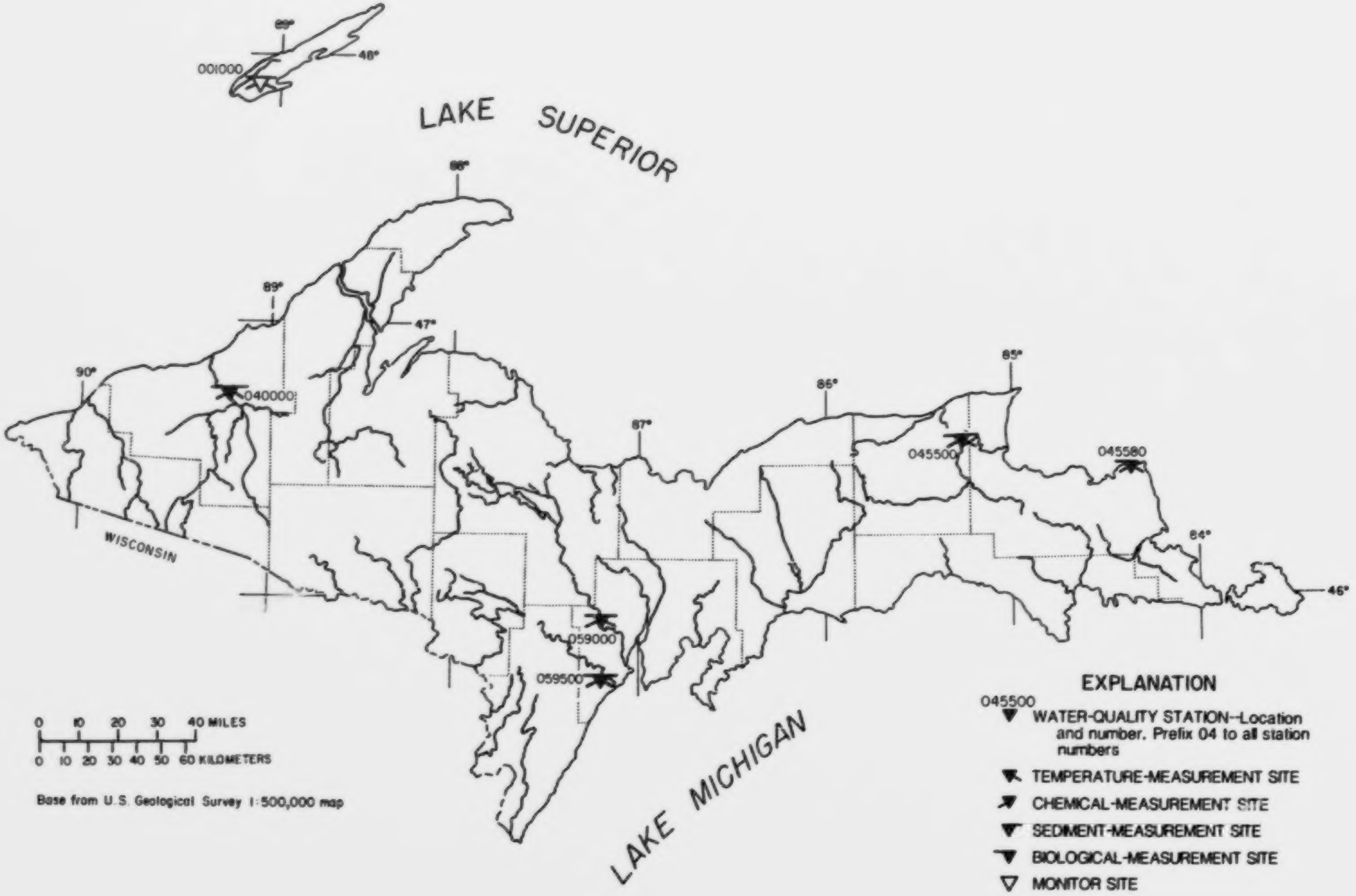
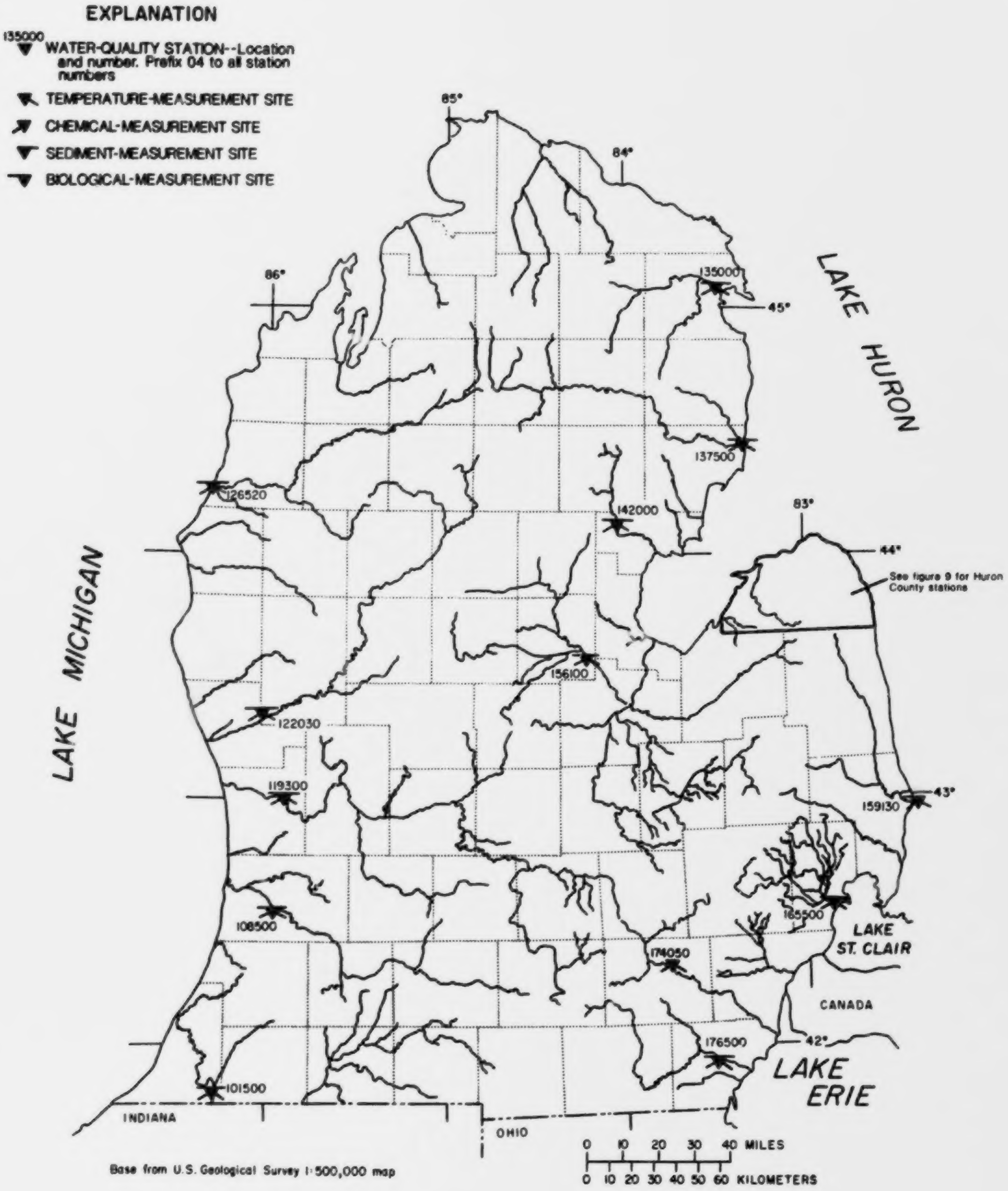

LAKE SUPERIOR
LAKE MICHIGAN
WISCONSIN
001000
040000
045500
045580
059000
059500
89°
48°
88°
89°
47°
90°
87°
86°
85°
84°
46°
0 10 20 30 40 MILES
0 10 20 30 40 50 60 KILOMETERS
Base from U.S. Geological Survey 1:500,000 map
EXPLANATION
045500
▼ WATER-QUALITY STATION--Location and number. Prefix 04 to all station numbers
TEMPERATURE-MEASUREMENT SITE
CHEMICAL-MEASUREMENT SITE
SEDIMENT-MEASUREMENT SITE
BIOLOGICAL-MEASUREMENT SITE
▽ MONITOR SITE

Figure 6.--Identification number and location of active surface-water-quality stations in the Upper Peninsula of Michigan.


EXPLANATION
135000 WATER-QUALITY STATION--Location and number. Prefix 04 to all station numbers
TEMPERATURE-MEASUREMENT SITE
CHEMICAL-MEASUREMENT SITE
SEDIMENT-MEASUREMENT SITE
BIOLOGICAL-MEASUREMENT SITE
85°
84°
86°
45°
83°
44°
43°
42°
LAKE HURON
LAKE MICHIGAN
135000
137500
126520
142000
See figure 9 for Huron County stations
156100
122030
119300
159130
108500
165500
LAKE ST. CLAIR
174050
CANADA
176500
LAKE ERIE
101500
INDIANA
OHIO
0 10 20 30 40 MILES
0 10 20 30 40 50 60 KILOMETERS

Base from U.S. Geological Survey 1:500,000 map

Figure 7.--Identification number and location of active surface-water-quality stations in the Lower Peninsula of Michigan.

04001000 WASHINGTON CREEK AT WINDIGO, MI
(Hydrologic bench-mark station)

LOCATION.--Lat 47°55'23", long 89°08'42", in NW1/4 sec.28, T.64 N., R.38 W., Keweenaw County, Isle Royale National Park, Hydrologic Unit 04020300, on left bank 0.8 mi northeast of Windigo, and 35 mi southwest of Rock Harbor.

DRAINAGE AREA.--13.2 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder and concrete control. Elevation of gage is 605 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30 to Feb. 29, Mar. 13-22, Mar. 25 to Apr. 4, June 6-20 and Sept. 8-17, 27-30. Water-discharge records good except for periods of ice effect and period of no gage height record, Dec. 30 to Feb. 29, Mar. 13-22, Mar. 25 to Apr. 4, which are fair, and periods of indefinite stage-discharge relation, June 6-20, Sept. 8-17, 27-30, which are poor.

AVERAGE DISCHARGE.--24 years, 16.9 ft³/s, 17.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.- Maximum discharge, 480 ft³/s, May 1, 1972, gage height, 6.82 ft, from rating curve extended above 160 ft³/s based on runoff characteristics of nearby stations; maximum gage height, 6.88 ft, Jan. 13, 1975, backwater from ice; minimum daily discharge, 0.44 ft³/s, Aug. 25, 1977; minimum gage height, 2.54 ft, July 28, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 110 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Apr. 13	2300	*149	*4.99	No other peak greater than base discharge.			

Minimum discharge, 0.54 ft³/s, July 28, gage height, 2.54 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.6	11	15	5.4	3.5	3.3	14	32	6.7	1.3	.95	7.4
2	9.0	9.9	14	5.2	3.5	3.4	15	29	5.6	1.2	3.6	8.3
3	9.2	9.8	11	5.0	3.4	3.2	35	27	5.0	1.2	2.8	6.7
4	7.7	9.4	10	4.9	3.4	3.1	50	24	4.4	1.2	2.4	5.8
5	6.8	8.8	9.2	4.8	3.4	3.1	63	21	3.9	1.0	3.5	5.4
6	6.6	8.4	8.4	4.7	3.4	3.2	74	19	3.4	1.1	5.1	4.5
7	6.2	8.1	8.4	4.6	3.4	3.3	92	16	3.1	.92	6.0	3.7
8	5.9	7.8	9.6	4.6	3.4	3.3	90	15	4.0	.92	8.9	3.0
9	6.8	7.1	13	4.6	3.4	4.0	83	25	3.5	.96	5.3	2.7
10	6.9	6.5	15	4.7	3.3	4.0	98	25	3.1	.85	4.0	2.6
11	6.5	6.6	15	4.7	3.3	4.0	108	20	2.8	.80	2.9	2.4
12	6.2	6.8	15	4.7	3.3	3.9	116	18	2.6	.78	2.5	2.3
13	6.0	6.8	14	4.8	3.3	3.8	129	26	2.4	1.0	3.1	2.2
14	5.8	6.8	12	5.0	3.3	3.7	114	23	3.0	1.2	7.6	2.1
15	5.7	6.7	11	5.1	3.4	3.7	80	21	2.6	1.6	7.0	2.1
16	9.7	9.4	9.9	5.2	3.4	3.6	68	17	2.3	1.9	7.1	3.0
17	13	21	8.9	5.2	3.5	3.6	83	15	2.1	1.4	27	4.5
18	11	25	8.7	5.0	3.6	3.5	73	13	2.0	1.1	15	4.0
19	9.2	20	8.7	4.8	3.6	3.5	60	11	2.5	.98	9.4	10
20	10	14	8.6	4.6	3.6	3.5	53	11	2.2	.94	6.7	36
21	20	10	8.1	4.5	3.5	3.4	45	11	1.9	.87	5.5	24
22	16	9.3	7.9	4.3	3.5	3.5	41	10	2.4	.81	4.7	15
23	15	8.9	8.1	4.2	3.4	3.6	38	9.2	2.0	.77	20	12
24	23	8.7	7.7	4.0	3.4	4.0	40	8.3	1.9	.87	15	9.3
25	22	8.1	7.1	3.9	3.4	12	44	7.4	2.3	.94	15	7.6
26	20	7.9	6.7	3.8	3.5	20	46	7.6	2.0	.84	12	6.7
27	19	7.8	6.8	3.7	3.5	19	40	8.8	1.8	.70	9.1	6.1
28	16	7.8	6.2	3.7	3.5	17	37	8.9	1.7	.68	7.6	5.7
29	14	13	5.9	3.8	3.4	16	35	7.7	1.6	1.2	6.6	5.3
30	12	20	5.4	3.8	---	15	33	6.9	1.4	1.3	5.2	5.0
31	11	---	5.0	3.6	---	14	---	7.2	---	1.0	4.6	---
TOTAL	343.8	311.4	300.3	140.9	99.5	198.2	1897	501.0	86.2	32.33	236.15	215.4
MEAN	11.1	10.4	9.69	4.55	3.43	6.39	63.2	16.2	2.87	1.04	7.62	7.18
MAX	23	25	15	5.4	3.6	20	129	32	6.7	1.9	27	36
MIN	5.7	6.5	5.0	3.6	3.3	3.1	14	6.9	1.4	.68	.95	2.1
CFSM	.84	.79	.73	.35	.26	.48	4.79	1.23	.22	.08	.58	.54
IN.	.97	.88	.85	.40	.28	.56	5.35	1.41	.24	.09	.67	.61

CAL YR 1987 TOTAL 3723.60 MEAN 10.2 MAX 77 MIN 1.0 CFSM .77 IN 10.49
WTR YR 1988 TOTAL 4362.18 MEAN 11.9 MAX 129 MIN .68 CFSM .90 IN 12.29

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1965 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURE: October 1964 to current year.

INSTRUMENTATION.--Water-temperature recorder since Oct. 20, 1964. Digital recorder set for one-hour-interval punches.

REMARKS.--In addition to the daily-temperature record, quarterly samples were collected at or near gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--
WATER TEMPERATURE: Maximum, 24.5°C, July 8, 1987; minimum, 0.0°C on many days during winter.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURE: Maximum, 22.0°C, July 7, 8; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 21...	1230	18	109	7.43	3.5	2.2	12.6	96	110	14
FEB 03...	1400	3.4	134	7.80	0.5	1.4	--	--	<2	35
MAY 09...	1630	27	--	7.83	12.0	1.6	10.3	100	K18	140
JUL 21...	1100	0.92	218	8.08	16.5	5.6	7.8	82	120	190

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 21...	60	8	16	4.8	2.3	8	0.1	0.60	63	0
FEB 03...	72	9	19	6.0	3.7	10	0.2	0.50	77	0
MAY 09...	44	8	12	3.5	1.9	3	0.1	0.50	43	0
JUL 21...	100	6	28	7.8	5.5	10	0.2	0.80	118	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 21...	52	22	1.9	0.10	13	101	0.14	4.91	<0.010	<0.100
FEB 03...	63	16	3.1	0.10	16	105	0.14	0.96	0.010	0.100
MAY 09...	36	11	1.3	0.10	9.1	78	0.11	5.69	<0.010	<0.100
JUL 21...	96	9.4	8.5	0.10	14	143	0.19	0.36	<0.010	<0.100

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT										
21...	0.050	0.050	0.60	0.010	0.020	<0.010	50	<1	8	<0.5
FEB										
03...	--	0.060	0.30	0.010	0.010	<0.010	30	<1	11	<0.5
MAY										
09...	0.060	0.040	0.50	0.020	0.010	--	70	<1	8	<0.5
JUL										
21...	0.040	0.040	0.50	0.030	0.010	<0.010	20	1	14	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT										
21...	<1	<1	<3	4	330	<5	<4	12	<0.1	<10
FEB										
03...	<1	<1	<3	<1	360	<5	<4	18	<0.1	<10
MAY										
09...	<1	<1	<3	2	180	<5	<4	8	<0.1	<10
JUL										
21...	<1	<1	<3	2	280	<5	6	69	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	GROSS ALPHA, DISSOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DISSOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)
OCT										
21...	<1	<1	<1.0	28	<6	15	<0.4	<0.4	1.3	<0.4
FEB										
03...	<1	<1	<1.0	36	<6	<3	--	--	--	--
MAY										
09...	4	<1	<1.0	23	<6	30	<0.4	<0.4	0.9	<0.4
JUL										
21...	<1	<1	<1.0	58	<6	<3	--	--	--	--

DATE	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	URANIUM NATURAL DISSOLVED (UG/L AS U)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT							
21...	1.1	<0.4	<0.02	0.02	4	0.19	90
FEB							
03...	--	--	--	--	3	0.03	54
MAY							
09...	0.8	<0.4	0.03	0.02	9	0.66	62
JUL							
21...	--	--	--	--	10	0.02	96

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		OCTOBER			NOVEMBER			DECEMBER			JANUARY	
1	11.0	9.5	10.0	4.0	2.5	3.5	.0	.0	.0	.5	.5	.5
2	10.0	7.0	8.5	6.0	4.0	5.0	.0	.0	.0	.5	.5	.5
3	8.0	6.0	7.0	7.0	6.0	6.5	.5	.0	.5	.5	.5	.5
4	9.0	7.0	7.5	7.5	6.5	7.0	.0	.0	.0	.5	.5	.5
5	9.0	7.0	8.0	6.5	3.0	4.0	.5	.0	.0	.5	.0	.0
6	8.5	7.0	7.5	2.5	2.0	2.0	.5	.0	.5	.0	.0	.0
7	7.0	5.5	6.0	2.5	1.5	2.0	.5	.0	.0	.5	.0	.5
8	5.5	5.0	5.5	2.5	1.0	2.0	.0	.0	.0	.5	.5	.5
9	5.5	5.0	5.5	.5	.0	.0	.0	.0	.0	.5	.0	.5
10	4.5	3.5	4.0	.5	.0	.0	.0	.0	.0	.5	.0	.5
11	4.5	3.0	3.5	.5	.0	.0	.0	.0	.0	.5	.5	.5
12	4.5	3.5	4.0	.5	.0	.5	.0	.0	.0	.5	.5	.5
13	5.0	2.5	3.5	1.5	.5	.5	.5	.0	.0	.5	.0	.5
14	5.5	4.0	4.5	1.0	.5	.5	.5	.0	.5	.0	.0	.0
15	5.5	4.0	5.0	2.5	.5	1.5	.5	.5	.5	.5	.5	.5
16	6.5	5.5	6.0	4.0	2.5	3.0	.5	.0	.0	.5	.0	.5
17	6.5	5.5	6.0	4.5	2.0	3.5	.5	.0	.5	.5	.0	.5
18	6.0	5.5	5.5	2.0	1.0	1.5	.5	.0	.0	.5	.5	.5
19	5.5	4.0	5.0	1.5	.0	1.0	.5	.0	.5	.5	.5	.5
20	4.5	3.5	3.5	.0	.0	.0	.5	.5	.5	.5	.5	.5
21	4.0	3.5	3.5	.5	.0	.0	.5	.5	.5	.5	.5	.5
22	4.0	3.0	3.5	.0	.0	.0	.5	.5	.5	.5	.5	.5
23	4.0	2.5	3.5	.0	.0	.0	.5	.0	.0	.5	.5	.5
24	3.5	2.5	3.0	.0	.0	.0	.5	.0	.5	.5	.5	.5
25	4.0	2.5	3.0	.0	.0	.0	.5	.5	.5	1.0	.5	.5
26	5.0	4.0	4.5	.0	.0	.0	.5	.0	.5	.5	.5	.5
27	5.0	4.0	4.5	.5	.0	.0	.5	.0	.5	.5	.0	.5
28	4.5	3.5	4.0	.5	.0	.5	.5	.5	.5	.5	.0	.0
29	3.5	2.0	2.5	.5	.0	.5	.5	.5	.5	.5	.5	.5
30	4.0	3.0	3.5	.0	.0	.0	.5	.5	.5	.5	.5	.5
31	5.0	3.5	4.0	---	---	---	.5	.5	.5	.5	.5	.5
MONTH	11.0	2.0	5.0	7.5	.0	1.5	.5	.0	.5	1.0	.0	.5

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		FEBRUARY			MARCH			APRIL			MAY	
1	1.0	.5	.5							---	---	---
2	.5	.0	.0							---	---	---
3	---	---	---							---	---	---
4	---	---	---							---	---	---
5	---	---	---							---	---	---
6	---	---	---							---	---	---
7	---	---	---							---	---	---
8	---	---	---							---	---	---
9	---	---	---							---	---	---
10	---	---	---							13.0	9.0	11.0
11	---	---	---							11.5	8.5	10.0
12	---	---	---							9.5	7.5	8.0
13	---	---	---							10.0	6.0	7.5
14	---	---	---							10.5	6.0	8.5
15	---	---	---							11.5	8.5	10.0
16	---	---	---							11.5	8.0	9.5
17	---	---	---							12.0	6.5	9.0
18	---	---	---							13.5	7.5	10.0
19	---	---	---							15.5	9.5	12.0
20	---	---	---							15.0	11.5	13.0
21	---	---	---							16.5	12.5	14.5
22	---	---	---							16.0	13.0	14.0
23	---	---	---							16.0	10.5	13.0
24	---	---	---							14.0	10.0	12.0
25	---	---	---							13.5	8.5	11.0
26	---	---	---							16.0	10.5	13.0
27	---	---	---							15.5	13.0	14.0
28	---	---	---							17.0	12.5	14.5
29	---	---	---							18.5	14.0	16.0
30	---	---	---							19.5	15.0	17.5
31	---	---	---							19.0	16.0	17.5
MONTH	1.0	.0	.5							19.5	6.0	12.0

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	19.5	15.5	17.0	14.5	12.5	13.5	18.0	16.5	17.5	15.5	14.0	14.5
2	16.0	14.0	15.0	16.0	14.0	15.0	17.5	16.5	17.0	15.5	13.5	14.5
3	16.0	10.5	13.5	17.0	14.0	15.5	19.0	16.5	17.5	16.0	14.0	15.0
4	16.0	11.0	13.5	18.5	15.5	17.0	19.0	17.5	18.0	15.5	14.0	15.0
5	18.5	13.5	15.5	18.5	17.5	18.0	18.5	17.0	17.5	14.0	12.5	13.5
6	19.5	15.5	17.5	20.5	17.0	18.5	19.0	16.0	17.5	13.5	10.5	12.0
7	18.5	15.5	17.0	22.0	19.0	20.5	18.0	16.5	17.0	13.5	10.0	11.5
8	17.0	13.5	15.0	22.0	20.0	21.0	18.0	15.5	16.5	13.5	12.5	13.0
9	15.5	11.0	13.5	21.5	19.5	20.5	18.0	14.5	16.0	13.5	11.0	12.5
10	15.5	10.5	13.0	21.0	18.5	20.0	18.5	14.5	16.5	13.5	11.0	12.5
11	16.5	12.5	14.0	19.5	18.5	18.5	19.5	17.0	18.0	13.0	11.0	12.0
12	17.0	13.0	15.0	18.0	15.5	16.5	19.0	17.5	18.5	14.0	12.5	13.0
13	18.0	14.5	16.5	17.0	15.5	16.0	19.0	18.0	18.0	13.0	10.5	12.0
14	18.5	15.5	17.0	17.0	15.5	16.5	18.5	17.5	17.5	12.5	10.0	11.5
15	18.0	15.5	16.5	16.5	15.0	15.5	19.0	15.5	17.5	11.5	10.0	11.0
16	17.0	14.0	15.5	17.0	14.0	15.0	18.0	16.5	17.5	12.5	11.5	12.0
17	16.0	12.0	14.0	18.0	15.5	16.5	17.5	17.0	17.0	14.0	12.0	13.0
18	15.5	13.5	14.5	18.5	16.5	17.5	17.0	15.0	16.0	13.5	11.5	12.5
19	18.5	14.5	16.5	18.0	16.0	17.0	16.0	13.5	14.5	14.0	13.5	13.5
20	18.0	15.5	17.0	18.5	16.5	17.5	15.0	12.5	14.0	14.0	12.5	13.5
21	17.5	15.0	16.0	18.5	16.5	17.5	16.0	13.0	14.5	12.5	11.5	12.0
22	18.5	16.0	17.5	18.5	16.5	17.5	16.0	14.5	15.0	12.0	11.5	11.5
23	18.0	14.0	15.5	19.0	16.5	17.5	16.0	15.0	15.5	12.0	10.5	11.0
24	14.0	12.5	13.0	18.0	17.0	17.5	17.0	15.0	16.0	10.5	9.0	10.0
25	15.5	13.0	14.0	18.5	16.5	17.5	16.0	15.0	15.5	11.5	10.0	10.5
26	16.0	13.0	14.5	18.0	16.5	17.0	15.5	14.0	14.5	10.0	9.5	10.0
27	16.0	14.0	15.0	19.0	16.5	17.5	15.5	14.0	14.5	10.5	10.0	10.0
28	16.0	14.0	15.0	21.0	17.5	19.0	15.0	13.5	14.0	10.0	8.5	9.5
29	15.0	12.5	14.0	20.5	19.5	20.0	14.0	12.5	13.5	10.0	9.0	9.5
30	15.0	12.5	14.0	19.5	17.5	18.5	13.5	12.0	13.0	11.5	10.0	10.5
31	---	---	---	18.5	17.0	17.5	14.5	11.5	13.0	---	---	---
MONTH	19.5	10.5	15.0	22.0	12.5	17.5	19.5	11.5	16.0	16.0	8.5	12.0

04033000 MIDDLE BRANCH ONTONAGON RIVER NEAR PAULDING, MI

LOCATION.--Lat 46°21'25", long 89°04'38", in SE1/4 NE1/4 sec.29, T.46 N., R.38 W., Ontonagon County, Hydrologic Unit 04020102, Ottawa National Forest, on right bank 25 ft downstream from bridge on Forest Service Road 172, 2.4 mi upstream from Bond Falls Reservoir, and 5.7 mi southeast of Paulding.

DRAINAGE AREA.--164 mi².

PERIOD OF RECORD.--June 1942 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,485.66 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Sept. 28, 1942, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 20-23, Dec. 2-7, and Dec. 15 to Mar. 30. Records excellent except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 174 ft³/s, 14.41 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,050 ft³/s, Apr. 30, 1951, gage height, 10.0 ft, from floodmark; minimum, 27 ft³/s, Nov. 22, 1946, result of freezeup; minimum gage height, 2.96 ft, Nov. 26, 1942, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 886 ft³/s, Apr. 7, gage height, 7.45 ft; minimum, 60 ft³/s, June 18, 19, July 7, 8, gage height, 3.46 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	105	149	197	128	115	103	193	148	94	99	70	88
2	136	147	180	124	112	103	223	147	96	89	83	86
3	166	144	150	122	108	104	301	142	91	84	97	105
4	151	157	180	118	105	105	441	137	84	81	106	174
5	141	162	170	115	105	108	596	134	83	77	138	188
6	156	155	168	112	105	113	765	130	81	76	143	153
7	181	155	165	110	105	120	875	126	79	71	121	133
8	180	153	168	108	105	130	833	125	79	68	103	128
9	165	148	188	107	103	140	722	178	81	72	94	119
10	154	144	231	107	102	150	634	205	77	80	87	104
11	145	139	218	107	102	160	551	177	74	76	87	96
12	137	136	207	110	100	165	471	160	73	72	93	93
13	134	135	197	113	100	160	410	162	70	72	109	100
14	133	133	191	120	102	155	362	159	77	72	151	101
15	137	130	180	125	104	150	323	151	76	90	144	92
16	241	133	170	120	105	148	296	148	73	154	116	87
17	278	174	160	118	105	145	270	138	71	128	130	131
18	248	256	155	114	105	142	259	130	70	109	153	162
19	208	232	150	112	105	140	240	124	78	97	137	146
20	186	190	150	115	105	137	224	120	85	90	114	166
21	173	160	150	118	105	135	209	119	77	91	98	186
22	173	188	150	120	105	135	196	122	124	87	94	176
23	176	180	145	120	105	138	190	124	179	83	120	162
24	176	166	140	120	105	140	191	117	132	81	126	145
25	172	157	140	118	105	200	186	110	113	87	119	132
26	164	152	135	116	105	470	179	107	125	81	114	126
27	169	149	135	116	103	370	168	106	108	80	107	124
28	170	145	140	116	103	300	160	104	101	71	104	116
29	164	164	135	120	103	240	157	100	124	66	99	112
30	159	202	135	120	---	210	151	97	116	68	95	109
31	155	---	130	120	---	201	---	95	---	70	89	---
TOTAL	5233	4835	5110	3609	3037	5217	10776	4142	2791	2622	3441	3840
MEAN	169	161	165	116	105	168	359	134	93.0	84.6	111	128
MAX	278	256	231	128	115	470	875	205	179	154	153	188
MIN	105	130	130	107	100	103	151	95	70	66	70	86
CFSM	1.03	.98	1.01	.71	.64	1.02	2.19	.82	.57	.52	.68	.78
IN.	1.19	1.10	1.16	.82	.69	1.18	2.44	.94	.63	.59	.78	.87

CAL YR 1987 TOTAL 51348 MEAN 141 MAX 359 MIN 93 CFSM .86 IN 11.65
WTR YR 1988 TOTAL 54653 MEAN 149 MAX 875 MIN 66 CFSM .91 IN 12.40

04033500 BOND FALLS CANAL NEAR PAULDING, MI

LOCATION.--Lat 46°23'57", long 89°08'47", in SW1/4 NE1/4 sec.11, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 40 ft upstream from intake to pipeline No. 2, 0.8 mi downstream from Bond Falls Reservoir on Middle Branch Ontonagon River, and 1.6 mi east of Paulding.

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 1,441.59 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, nonrecording gage at datum 3.00 ft higher.

REMARKS.--Estimated daily discharges: Jan. 10, 11, 13-15, 21-28, and Feb. 2-8, 10-12, 24, 25. Records excellent except those below 5.0 ft^3/s, which are poor. Canal diverts water from Bond Falls Reservoir (station 04034000) to South Branch Ontonagon River; water is used for power production at Victoria Dam near Rockland. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 142 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 368 ft^3/s, May 5, 1960; no flow for several days in 1963-70, 1973-75, 1982, 1987.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	100	106	113	150	200	134	6.9	45	306	60	29	105
2	100	106	92	149	200	132	7.3	137	302	85	29	106
3	100	106	63	149	200	126	8.2	281	251	86	29	106
4	101	106	53	170	200	115	8.4	301	199	86	30	105
5	101	106	53	226	200	99	8.2	308	199	63	29	105
6	100	105	53	260	195	99	8.0	199	169	30	29	105
7	100	106	53	260	195	92	8.2	45	111	30	29	117
8	100	105	53	262	195	75	8.5	29	96	30	29	139
9	101	103	54	258	196	67	8.7	162	96	30	29	147
10	100	130	33	260	195	39	9.0	328	78	30	67	146
11	100	155	10	260	195	6.9	9.0	326	43	29	110	147
12	101	152	10	261	190	6.4	9.2	326	43	29	92	147
13	101	180	10	260	190	6.4	5.8	218	42	29	85	146
14	101	200	10	260	188	6.4	4.5	32	40	28	84	145
15	101	201	10	255	187	6.4	3.8	32	39	30	84	133
16	57	201	10	255	191	6.4	2.6	150	39	30	84	111
17	8.0	201	10	253	188	6.4	2.3	313	39	29	84	103
18	8.0	170	10	251	173	6.4	86	314	39	29	83	102
19	8.0	117	30	251	154	6.4	224	312	39	54	83	102
20	8.0	114	58	249	152	6.1	273	221	37	87	136	102
21	8.0	114	58	250	152	6.0	316	31	37	87	186	102
22	8.6	114	58	235	164	6.1	309	30	37	86	187	102
23	9.0	114	77	206	176	6.4	311	169	37	86	186	102
24	9.0	114	98	206	180	6.6	313	327	37	86	185	102
25	9.4	126	98	206	180	7.2	310	327	37	64	185	103
26	9.4	139	98	206	180	6.6	306	321	36	28	184	104
27	9.4	139	98	206	161	6.4	303	313	36	28	183	103
28	9.4	139	118	206	137	6.5	303	311	36	29	182	103
29	29	142	152	206	137	6.8	216	311	37	29	160	103
30	89	129	152	206	---	6.8	73	309	37	28	117	103
31	106	---	152	205	---	6.8	---	307	---	28	106	---
TOTAL	1892.2	4040	1947	7037	5251	1114.4	3461.6	6835	2574	1483	3115	3446
MEAN	61.0	135	62.8	227	181	35.9	115	220	85.8	47.8	100	115
MAX	106	201	152	262	200	134	316	328	306	87	187	147
MIN	8.0	103	10	149	137	6.0	2.3	29	36	28	29	102

CAL YR 1987 TOTAL 33792.7 MEAN 92.6 MAX 255 MIN .00
WTR YR 1988 TOTAL 42196.2 MEAN 115 MAX 328 MIN 2.3

04034000 BOND FALLS RESERVOIR NEAR PAULDING, MI

LOCATION.--Lat 46°24'29", long 89°07'42", in SW1/4 sec.1, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, at Bond Falls Dam on Middle Branch Ontonagon River, 2.5 mi east of Paulding.

DRAINAGE AREA.--190 mi².

PERIOD OF RECORD.--June 1942 to current year. Prior to October 1950, monthend contents only published in WSP 1307.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Nonrecording gage read once daily. Datum of gage is 1,335.59 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Reservoir is formed by earthfill and concrete dam with one taintor gate; dam completed in 1937. Capacity of reservoir, 41,300 acre-ft between gage heights of 120 ft (maximum drawdown) and 141 ft (full pond). Dead storage unknown. Water diverted to South Branch Ontonagon River through Bond Falls Canal (station 04033500); water used for power production at Victoria Dam near Rockland.

COOPERATION.--Gage-height record provided by Upper Peninsula Power Co. and converted to acre-feet by U.S. Geological Survey.

EXTREMES FOR PERIOD OF RECORD (SINCE 1947).--Maximum contents observed, 42,980 acre-ft, July 3, 1953, gage height, 141.7 ft, of which 1,680 acre-ft was uncontrolled storage; no usable storage at times; minimum gage height observed, 116.0 ft, Mar. 21, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 35,450 acre-ft, Apr. 16, gage height, 138.50 ft; minimum, 13,420 acre-ft, Mar. 4-9, gage height, 127.8 ft.

MONTHEND GAGE HEIGHT AND CONTENTS AT 1030, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	131.3	20,100	--	--
Oct. 31	133.8	25,100	+5,000	+81.3
Nov. 30	133.6	24,700	-400	-6.7
Dec. 31	135.8	29,360	+4,660	+75.8
CAL YR 1987	--	--	+11,380	+15.7
Jan. 31	131.5	20,500	-8,860	-144
Feb. 29	128.1	13,990	-6,510	-113
Mar. 31	130.8	19,120	+5,130	+83.4
Apr. 30	137.1	32,230	+13,110	+220
May 31	133.6	24,700	-7,530	-122
June 30	132.2	21,900	-2,800	-47.1
July 31	131.9	21,300	-600	-9.8
Aug. 31	131.5	20,500	-800	-13.0
Sept. 30	131.2	19,900	-600	-10.1
WTR YR 1988	--	--	-200	-0.3

04034500 MIDDLE BRANCH ONTONAGON RIVER NEAR TROUT CREEK, MI

LOCATION.--Lat 46°28'40", long 89°05'25", in SW1/4 sec.8, T.47 N., R.38 W., Ontonagon County, Hydrologic Unit 04020102, on right bank 0.1 mi upstream from State Highway 28, 3.8 mi west of village of Trout Creek, and 7.5 mi downstream from Bond Falls Reservoir.

DRAINAGE AREA.--203 mi².

PERIOD OF RECORD.--June 1942 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,132.03 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Nov. 4, 1942, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharge: Jan. 2-15, 27, 28, Feb. 2, 3, 5-8, 11-16, 21-23 and Mar. 1, 3, 4, 20, 21. Records excellent except for estimated daily discharges, which are good. Flow regulated by Bond Falls Reservoir (station 04034000) 7.5 mi upstream. Diversion to South Branch Ontonagon River 8.5 mi upstream by Bond Falls Canal (station 04033500). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 65.5 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,750 ft³/s, Nov. 7, 1951, gage height, 5.05 ft; minimum, 14 ft³/s, sometime during period Jan. 23 to Feb. 13, 1947, gage height, 1.14 ft, from recorded range in stage, caused by ice jams upstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 180 ft³/s, Aug. 13, gage height, 2.29 ft; minimum daily, 43 ft³/s, May 30, 31, Sept. 9-11, 13-16, 18, 25, 28, 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	48	49	53	52	47	45	55	45	46	54	58	52
2	52	49	51	52	48	45	61	45	55	54	63	46
3	60	50	50	52	48	45	94	45	55	54	61	49
4	52	50	51	52	48	45	111	45	55	53	67	49
5	50	50	49	51	48	46	101	45	55	53	64	48
6	51	49	49	51	48	45	100	45	54	53	58	46
7	54	49	51	51	48	45	76	45	54	52	57	45
8	55	48	50	51	48	47	66	47	55	53	57	45
9	52	48	69	50	48	46	62	54	55	54	57	43
10	51	48	67	50	48	46	60	49	54	54	57	43
11	50	48	58	50	48	46	57	46	54	54	57	43
12	49	48	55	50	48	45	56	47	54	54	59	44
13	49	48	53	50	48	46	55	48	54	54	89	43
14	49	48	52	50	47	45	53	46	55	54	76	43
15	48	48	52	50	47	46	53	46	55	60	59	43
16	59	48	52	51	47	45	53	46	55	56	57	43
17	73	64	51	50	46	46	53	46	55	55	99	48
18	57	60	51	50	46	45	52	45	55	55	63	43
19	53	53	53	50	46	46	52	45	57	55	58	44
20	51	51	53	51	46	46	52	45	55	57	57	46
21	50	49	51	48	45	45	52	46	55	56	54	46
22	52	49	52	50	45	46	51	46	56	55	55	45
23	52	49	52	50	45	45	52	46	55	55	57	45
24	52	48	52	49	45	47	52	45	55	55	55	44
25	52	48	50	48	45	63	51	45	55	55	58	43
26	50	48	47	48	45	57	47	45	55	55	55	46
27	50	48	53	48	45	52	46	45	55	55	55	44
28	50	48	52	49	45	51	46	45	57	55	54	43
29	50	58	51	50	44	52	46	44	54	55	54	45
30	50	57	52	49	---	54	46	43	54	56	54	43
31	49	---	53	48	---	53	---	43	---	56	54	---
TOTAL	1620	1508	1635	1551	1352	1476	1811	1418	1638	1696	1878	1350
MEAN	52.3	50.3	52.7	50.0	46.6	47.6	60.4	45.7	54.6	54.7	60.6	45.0
MAX	73	64	69	52	48	63	111	54	57	60	99	52
MIN	48	48	47	48	44	45	46	43	46	52	54	43

CAL YR 1987 TOTAL 18619 MEAN 51.0 MAX 82 MIN 43
WTR YR 1988 TOTAL 18933 MEAN 51.7 MAX 111 MIN 43

04035500 MIDDLE BRANCH ONTONAGON RIVER NEAR ROCKLAND, MI

LOCATION.--Lat 46°41'57", long 89°09'36", in SE1/4 sec.27, T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 10 ft upstream from bridge on U.S. Highway 45, 700 ft downstream from East Branch, and 2.8 mi southeast of Rockland.

DRAINAGE AREA.--671 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 661.1 ft above National Geodetic Vertical Datum of 1929. Prior to Apr. 1, 1959, nonrecording gage at site 400 ft upstream at same datum. Apr. 1, 1959 to Oct. 21, 1968, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 2-5 and Dec. 16 to Apr. 1. Records good except for estimated daily discharges, which are fair. Regulation by Bond Fall Reservoir (station 04034000) 30.0 mi upstream. Diversion to South Branch Ontonagon River by Bond Falls Canal (station 04033500) 31.0 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE--46 years, 528 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 27,000 ft³/s, Aug. 22, 1942, gage height, 21.2 ft, from floodmarks, from rating curve extended above 7,500 ft³/s, on basis of slope-area measurement of peak flow; minimum observed, 142 ft³/s, Dec. 3, 1963, discharge measurement; minimum daily, 145 ft³/s, Dec. 3, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,980 ft³/s, Apr. 4, gage height, 10.26 ft; minimum, 167 ft³/s, July 31, gage height, 3.35 ft; minimum daily, 170 ft³/s, July 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	190	287	792	255	250	260	1050	251	202	189	178	218
2	383	282	475	250	240	255	1880	243	199	186	264	208
3	581	281	360	245	240	250	4150	234	200	185	263	205
4	396	285	350	240	240	250	5590	226	196	185	354	225
5	318	289	340	240	245	255	4480	223	195	181	538	232
6	336	284	331	235	245	265	4510	220	195	178	366	229
7	663	274	338	230	245	275	3280	219	194	177	278	220
8	535	270	354	230	240	290	2430	222	197	174	235	208
9	404	264	1220	230	240	305	2060	449	202	172	205	204
10	354	257	2010	235	235	315	1560	504	198	173	196	204
11	313	251	976	238	235	320	1100	414	195	172	189	194
12	289	253	722	240	235	320	876	347	191	171	185	193
13	274	256	565	265	240	320	734	422	188	172	279	193
14	259	251	457	300	240	310	572	375	196	175	1710	194
15	277	249	389	300	245	300	464	320	194	188	635	190
16	2170	252	350	290	250	290	429	289	193	218	362	191
17	1540	632	335	285	250	285	462	269	193	210	2620	209
18	791	1510	320	280	255	280	412	253	193	193	1860	235
19	545	792	330	280	255	280	358	241	199	184	747	235
20	424	526	340	280	260	275	336	230	201	179	477	239
21	377	360	320	270	260	260	312	226	198	198	366	254
22	405	380	300	270	260	265	302	265	195	190	301	255
23	429	369	295	270	260	275	305	270	191	184	310	244
24	408	344	290	265	261	300	330	251	188	182	301	229
25	369	316	290	260	265	950	324	231	189	180	293	218
26	341	307	280	260	265	2200	309	224	190	178	320	247
27	329	292	270	255	265	1700	285	230	188	176	293	283
28	329	286	260	255	260	1300	276	236	190	173	264	265
29	330	866	270	265	260	1050	269	225	198	170	242	245
30	316	1420	270	270	---	930	260	209	195	175	235	236
31	301	---	260	260	---	900	---	204	---	171	225	---
TOTAL	14976	12685	14459	8048	7231	15830	39704	8522	5843	5639	15091	6702
MEAN	483	423	466	260	250	511	1323	275	195	182	487	223
MAX	2170	1510	2010	300	265	2200	5590	504	202	218	2620	283
MIN	190	249	260	230	235	250	260	204	188	170	178	190

CAL YR 1987 TOTAL 130821 MEAN 358 MAX 2180 MIN 185
WTR YR 1988 TOTAL 154740 MEAN 423 MAX 5590 MIN 170

04035995 LAKE GOGEBIC NEAR BERGLAND, MI

LOCATION.--Lat 46°35'19", long 89°32'52", in SW1/4 NW1/4 sec.3, T.48 N., R.42 W., Ontonagon County, Hydrologic Unit 04020102, at upstream side of dam on lake outlet, 1.0 mi southeast of Bergland, and 4.3 mi east of Merriweather.

DRAINAGE AREA.--162 mi².

PERIOD OF RECORD.--July 1958 to September 1959 (no winter record), February 1969 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,293.70 ft above National Geodetic Vertical Datum of 1929. July 1958 to September 1959, nonrecording gage at mouth of Merriweather Creek at different datum.

REMARKS.--Lake Gogebic is used as a storage reservoir (capacity 35,200 acre-ft) by Upper Peninsula Power Company for power production at Victoria Dam near Rockland. Lake level is controlled at the outlet by a concrete dam with removable flash boards. Major inlets to Lake Gogebic are Slate River, Trout Brook, and Merriweather Creek. Streamflow records are currently collected at the outlet, West Branch Ontonagon River (station 04036000). Surface area of lake is 14,780 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 3.30 ft, Apr. 22, 1971; minimum daily, -0.32 ft, Apr. 5, 6, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 2.87 ft, May 12, result of wind action; maximum daily, 2.23 ft, May 29; minimum gage height, -0.03 ft, Mar. 12, result of wind action; minimum daily, 0.05 ft, Mar. 11, 24.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.75	1.75	1.73	1.50	.85	.20	.24	2.02	2.20	1.77	1.56	1.84
2	1.65	1.74	1.77	1.47	.82	.18	.28	2.04	2.17	1.77	1.69	1.79
3	1.77	1.73	1.76	1.42	.81	.16	.39	2.03	2.15	1.76	1.72	1.78
4	1.78	1.72	1.76	1.39	.78	.15	.57	2.03	2.15	1.77	1.78	1.75
5	1.80	1.66	1.76	1.36	.76	.13	.81	2.04	2.15	1.75	1.87	1.78
6	1.75	1.66	1.75	1.31	.75	.11	1.08	2.03	2.14	1.76	1.83	1.80
7	1.75	1.63	1.74	1.27	.74	.09	1.34	2.08	2.10	1.76	1.84	1.82
8	1.82	1.57	1.74	1.24	.69	.10	1.55	2.06	2.05	1.71	1.80	1.83
9	1.81	1.57	1.78	1.21	.65	.09	1.71	2.11	2.02	1.71	1.82	1.92
10	1.80	1.56	1.86	1.18	.61	.08	1.84	2.12	2.00	1.69	1.83	1.73
11	1.83	1.57	1.88	1.15	.59	.05	1.90	2.14	1.99	1.63	1.80	1.73
12	1.81	1.53	1.91	1.14	.57	.06	1.93	2.17	1.96	1.63	1.80	1.74
13	1.83	1.51	1.91	1.14	.54	.08	1.93	2.16	1.94	1.68	1.84	1.76
14	1.81	1.49	1.88	1.12	.51	.10	1.91	2.18	1.97	1.60	2.05	1.70
15	1.80	1.50	1.86	1.09	.49	.10	1.88	2.18	1.94	1.68	1.98	1.70
16	1.90	1.51	1.87	1.07	.47	.10	1.86	2.12	1.86	1.68	1.98	1.72
17	1.92	1.50	1.85	1.04	.44	.09	1.79	2.14	1.86	1.68	1.98	1.75
18	1.97	1.61	1.83	1.03	.42	.09	1.79	2.16	1.88	1.66	1.97	1.74
19	1.94	1.63	1.81	1.01	.38	.08	1.86	2.16	1.93	1.65	1.96	1.77
20	1.92	1.58	1.82	1.00	.35	.08	1.86	2.16	1.87	1.65	1.93	1.84
21	1.91	1.64	1.78	1.01	.35	.07	1.88	2.16	1.87	1.64	1.91	1.84
22	1.92	1.63	1.75	1.00	.32	.07	1.87	2.16	1.86	1.64	1.92	1.87
23	1.93	1.61	1.73	.97	.34	.06	1.90	2.17	1.85	1.64	1.92	1.91
24	1.90	1.63	1.71	.95	.29	.05	1.95	2.14	1.86	1.63	1.89	1.93
25	1.92	1.63	1.70	.94	.27	.12	1.97	2.17	1.83	1.59	1.88	1.90
26	1.94	1.63	1.66	.93	.25	.13	1.95	2.18	1.78	1.60	1.85	1.91
27	1.85	1.63	1.61	.92	.23	.14	1.96	2.19	1.79	1.60	1.83	1.89
28	1.85	1.62	1.58	.90	.23	.16	1.99	2.20	1.80	1.62	1.82	1.87
29	1.84	1.66	1.55	.87	.22	.18	2.00	2.23	1.80	1.61	1.79	1.87
30	1.79	1.68	1.52	.86	---	.19	2.01	2.21	1.78	1.57	1.79	1.89
31	1.77	---	1.53	.86	---	.21	---	2.20	---	1.58	1.80	---
MEAN	1.84	1.61	1.75	1.11	.51	.11	1.60	2.13	1.95	1.67	1.85	1.81
MAX	1.97	1.75	1.91	1.50	.85	.21	2.01	2.23	2.20	1.77	2.05	1.93
MIN	1.65	1.49	1.52	.86	.22	.05	.24	2.02	1.78	1.57	1.56	1.70

WTR YR 1988 MEAN 1.50 MAX 2.23 MIN .05

04036000 WEST BRANCH ONTONAGON RIVER NEAR BERGLAND, MI

LOCATION.--Lat 46°35'15", long 89°32'30", in SW1/4 NE1/4 sec.3, T.48 N., R.42 W., Ontonagon County, Hydrologic Unit 04020102, on right bank 0.4 mi downstream from dam at outlet of Lake Gogebic, and 1.5 mi east of Bergland.

DRAINAGE AREA.--162 mi^2.

PERIOD OF RECORD.--July 1942 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,290.81 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 5, 1942, nonrecording gage 0.4 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Jan. 6, 7 and Feb. 11-13, 23. Records excellent except those below 5.0 ft^3/s, which are fair. Flow regulated by Lake Gogebic (station 04035995). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 173 ft^3/s, 14.50 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,400 ft^3/s, Apr. 26, 1960, gage height, 5.98 ft; minimum daily, 0.45 ft^3/s, Sept. 18, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 672 ft^3/s, Apr. 13, gage height, 4.23 ft; minimum daily, 0.45 ft^3/s, Sept. 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.0	210	62	275	146	145	165	8.6	25	21	2.3	2.5
2	1.0	238	66	260	130	144	174	8.7	25	21	2.5	2.0
3	.96	255	103	277	133	142	197	8.4	25	21	2.2	1.8
4	.87	252	135	295	143	139	235	9.1	25	21	2.9	1.3
5	.85	235	131	279	153	137	285	11	24	17	2.8	.97
6	.89	233	130	265	149	135	359	12	61	10	2.4	.83
7	.92	222	130	255	144	132	440	14	79	9.7	2.2	.80
8	.92	202	129	251	192	133	509	15	110	9.4	2.1	.84
9	.92	171	102	242	228	133	572	16	107	9.2	2.0	.90
10	.91	153	34	234	225	131	619	15	106	8.3	2.0	.71
11	.87	154	129	224	212	127	644	15	104	7.4	1.8	.60
12	.84	144	156	223	209	126	655	32	101	7.4	1.7	.59
13	.82	140	193	223	203	133	655	18	82	7.7	2.3	.59
14	51	135	292	214	204	134	645	17	62	7.5	2.4	.55
15	65	136	309	211	201	134	635	17	59	4.9	1.8	.53
16	74	137	312	207	200	134	626	17	53	3.8	45	.54
17	76	136	306	198	192	134	592	17	44	3.7	69	.51
18	92	122	303	189	188	134	360	17	22	3.7	68	.45
19	160	75	293	183	184	133	56	18	22	3.2	104	.55
20	156	51	292	181	175	132	28	19	22	2.8	120	.88
21	156	58	286	187	173	129	20	21	22	2.6	114	.71
22	161	57	274	181	172	128	17	22	22	2.3	114	.75
23	175	57	265	175	164	128	14	22	22	1.8	114	.88
24	197	58	259	174	160	127	14	22	22	1.7	112	.86
25	201	94	256	166	157	138	12	23	22	1.7	110	.86
26	219	117	293	164	155	141	9.3	23	22	1.6	106	.93
27	236	117	315	156	154	142	9.2	26	21	1.6	105	65
28	236	117	305	153	153	145	9.8	26	21	1.6	85	109
29	232	122	292	148	147	152	9.7	26	21	1.6	17	110
30	252	85	285	144	---	156	8.8	26	21	1.7	2.2	112
31	234	---	285	146	---	160	---	25	---	1.9	2.2	---
TOTAL	2984.77	4283	6722	6480	5046	4238	8574.8	566.8	1374	219.8	1320.8	419.43
MEAN	96.3	143	217	209	174	137	286	18.3	45.8	7.09	42.6	14.0
MAX	252	255	315	295	228	160	655	32	110	21	120	112
MIN	.82	51	34	144	130	126	8.8	8.4	21	1.6	1.7	.45

CAL YR 1987 TOTAL 28749.73 MEAN 78.8 MAX 315 MIN .82 CFSM .49 IN 6.60
WTR YR 1988 TOTAL 42229.40 MEAN 115 MAX 655 MIN .45 CFSM .71 IN 9.70

04037400 CISCO LAKE NEAR WATERSMEET, MI

LOCATION.--Lat 46°15'10", long 89°27'07", in NE1/4 sec.32, T.45 N., R.41 W., Gogebic County, Hydrologic Unit 04020102, on left bank at outlet, 10 ft upstream from dam, 13 mi west of Watersmeet.

DRAINAGE AREA.--50.6 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,679.53 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 28, 1969, nonrecording gage at same site and datum.

REMARKS.--Record for Dec. 4-7, Jan. 5-13, 15-17, and Feb. 4-15 is from once daily gage readings furnished by Upper Peninsula Power Company. Record for Jan. 14 is from gage inspection by USGS personnel. Cisco Lake (capacity 15,600 acre-ft) is the downstream lake in a chain of lakes used as storage reservoirs by Upper Peninsula Power Company for power production at Victoria Dam near Rockland. Lake level is controlled at the outlet by a concrete dam of two bays with removable flash boards. The major inlet to Cisco Lake is the combined outlet from Lindsley Lake and Thousand Island Lake. Streamflow records are currently collected at the outlet, Cisco Branch Ontonagon River (station 04037500). The lake level is maintained at an elevation of about 1,682.5 ft, above NGVD, during winter months and 1,683.5 ft, above NGVD, during summer months. Surface area of lake is 506 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 4.69 ft, July 19, 1942; minimum, 1.72 ft, Mar. 20-22, 1948.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.17 ft, Sept. 5, 6; minimum, 3.02 ft, Mar. 24.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.96	3.48	3.12	3.12	3.05	3.13	3.14	3.56	3.82	3.92	3.82	3.98
2	3.97	3.46	3.12	3.11	3.06	3.13	3.15	3.57	3.83	3.92	3.85	3.97
3	4.02	3.43	3.11	3.09	3.07	3.13	3.20	3.57	3.80	3.91	3.87	4.09
4	4.03	3.40	3.08	3.08	3.10	3.13	3.23	3.57	3.79	3.91	3.94	4.14
5	4.01	3.37	3.08	3.10	3.10	3.13	3.27	3.57	3.79	3.91	3.98	4.15
6	3.97	3.37	3.06	3.13	3.10	3.13	3.34	3.58	3.79	3.91	3.98	4.16
7	3.96	3.36	3.10	3.10	3.10	3.13	3.38	3.62	3.78	3.90	4.00	4.13
8	3.97	3.32	3.09	3.10	3.10	3.16	3.41	3.61	3.78	3.88	3.97	4.05
9	3.90	3.28	3.14	3.10	3.10	3.15	3.42	3.69	3.76	3.91	3.97	3.98
10	3.90	3.26	3.19	3.10	3.12	3.13	3.42	3.67	3.75	3.90	3.98	3.96
11	3.91	3.23	3.20	3.12	3.12	3.12	3.42	3.70	3.75	3.89	3.97	4.00
12	3.91	3.21	3.21	3.12	3.12	3.12	3.42	3.72	3.75	3.90	3.98	3.98
13	3.93	3.18	3.22	3.12	3.14	3.13	3.42	3.71	3.74	3.90	4.02	3.98
14	3.92	3.17	3.21	3.18	3.14	3.13	3.42	3.76	3.74	3.87	4.06	3.98
15	3.97	3.17	3.19	3.18	3.14	3.13	3.42	3.74	3.71	3.93	4.07	3.99
16	4.06	3.17	3.20	3.20	3.13	3.12	3.44	3.72	3.72	3.91	4.06	4.03
17	3.98	3.18	3.19	3.16	3.14	3.10	3.40	3.75	3.71	3.92	4.07	4.08
18	3.93	3.21	3.20	3.16	3.15	3.09	3.38	3.77	3.71	3.90	4.03	4.07
19	3.88	3.16	3.19	3.14	3.15	3.08	3.41	3.77	3.74	3.90	3.99	4.08
20	3.84	3.15	3.20	3.15	3.15	3.07	3.40	3.77	3.72	3.89	3.96	4.07
21	3.80	3.16	3.20	3.16	3.15	3.06	3.42	3.80	3.74	3.89	3.97	4.06
22	3.79	3.14	3.18	3.15	3.15	3.05	3.45	3.80	3.85	3.89	3.99	4.05
23	3.75	3.13	3.18	3.15	3.13	3.03	3.46	3.80	3.88	3.88	3.99	3.99
24	3.70	3.12	3.17	3.14	3.12	3.04	3.49	3.79	3.89	3.87	3.97	3.99
25	3.69	3.11	3.17	3.13	3.10	3.11	3.50	3.80	3.84	3.85	3.96	3.98
26	3.66	3.09	3.17	3.12	3.09	3.13	3.51	3.80	3.85	3.86	3.97	4.00
27	3.62	3.07	3.15	3.11	3.10	3.13	3.50	3.81	3.85	3.85	3.97	3.98
28	3.62	3.06	3.14	3.10	3.11	3.14	3.52	3.83	3.89	3.84	3.96	4.01
29	3.60	3.09	3.13	3.09	3.12	3.14	3.53	3.83	3.93	3.83	3.95	4.02
30	3.53	3.10	3.13	3.07	---	3.14	3.55	3.83	3.92	3.82	3.96	4.01
31	3.51	---	3.12	3.06	---	3.14	---	3.83	---	3.83	3.98	---
MEAN	3.85	3.22	3.16	3.12	3.12	3.11	3.40	3.72	3.79	3.89	3.98	4.03
MAX	4.06	3.48	3.22	3.20	3.15	3.16	3.55	3.83	3.93	3.93	4.07	4.16
MIN	3.51	3.06	3.06	3.06	3.05	3.03	3.14	3.56	3.71	3.82	3.82	3.96

WTR YR 1988 MEAN 3.53 MAX 4.16 MIN 3.03

04037500 CISCO BRANCH ONTONAGON RIVER AT CISCO LAKE OUTLET, MI

LOCATION.--Lat 46°15'12", long 89°27'05", in NE1/4 sec.32, T.45 N., R.41 W., Gogebic County, Hydrologic Unit 04020102, on left bank 80 ft downstream from Cisco Lake Dam, 2.5 mi upstream from Langford Creek, 5.0 mi upstream from U.S. Highway 2, and 13 mi west of Watersmeet.

DRAINAGE AREA.--50.7 mi².

PERIOD OF RECORD.--October 1944 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,672.69 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, nonrecording gage at same site and at datum 4.00 ft higher.

REMARKS.--No estimated daily discharges. Records good except those below 1.5 ft³/s, which are poor. Flow regulated by Cisco Lake (station 04037400). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 47.0 ft³/s, 12.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 288 ft³/s, May 1-4, 1951, gage height, 6.10 ft, present datum; minimum daily, 0.08 ft³/s, July 21, Aug. 2, 3, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 176 ft³/s, Oct. 17, gage height, 5.54 ft; minimum daily, 0.08 ft³/s, July 21, Aug. 2, 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.93	100	55	59	33	23	47	.34	.19	.17	.09	.28
2	1.1	94	53	61	14	23	48	.31	.18	.16	.08	.23
3	1.7	90	52	61	14	23	54	.29	.16	.13	.08	1.5
4	1.9	82	52	59	14	23	62	.31	.18	.12	.13	2.2
5	46	76	51	53	16	23	67	.32	.22	.10	.17	2.9
6	69	75	51	46	16	23	72	.31	.20	.10	.15	37
7	68	72	48	34	16	22	88	.29	.17	.10	.15	107
8	69	67	46	10	16	24	99	.29	.16	.10	.10	126
9	64	81	47	2.1	17	38	102	.26	.13	.10	.10	106
10	21	88	48	2.0	17	55	105	.20	.13	.10	.10	57
11	.76	81	47	2.0	17	54	104	.22	.13	.10	.09	1.8
12	.51	75	47	2.1	17	54	104	.23	.13	.10	.09	1.4
13	.40	71	46	2.1	17	54	103	.21	.13	.09	.14	1.4
14	.37	69	56	2.0	17	54	105	.26	.13	.09	.55	1.0
15	.81	62	76	14	17	53	105	.22	.13	21	18	.85
16	76	53	73	33	17	53	104	.22	.13	21	33	1.0
17	160	51	72	36	17	52	101	.19	.13	.20	55	51
18	162	69	65	42	18	52	43	.16	.13	.11	79	81
19	146	78	62	51	15	51	67	.16	.13	.09	76	94
20	137	76	60	52	19	51	34	.19	.13	.09	35	107
21	130	77	57	52	19	50	3.6	.19	.13	.08	.54	106
22	126	72	58	53	35	50	3.0	.19	.27	.09	.55	104
23	121	70	59	53	54	49	2.6	.19	.23	.09	.43	100
24	115	69	57	52	53	50	2.5	.19	.22	.09	.34	66
25	109	67	57	52	53	52	1.7	.19	.19	.10	.31	29
26	97	65	57	51	40	51	1.5	.16	.19	.10	.31	30
27	93	63	56	50	21	50	1.3	.17	.18	.12	.32	17
28	92	61	56	49	21	47	1.2	.17	.23	.09	.28	1.6
29	107	61	56	49	22	47	.88	.16	.23	.09	.26	1.5
30	108	58	58	48	---	47	.53	.17	.19	.09	.26	1.4
31	104	---	58	48	---	47	---	.18	---	.09	.30	---
TOTAL	2228.48	2173	1736	1180.3	666	1345	1632.81	6.94	5.08	45.08	301.92	1237.06
MEAN	71.9	72.4	56.0	38.1	23.0	43.4	54.4	.22	.17	1.45	9.74	41.2
MAX	162	100	76	61	54	55	105	.34	.27	21	79	126
MIN	.37	51	46	2.0	14	22	.53	.16	.13	.08	.08	.23

CAL YR 1987 TOTAL 11433.55 MEAN 31.3 MAX 162 MIN .22 CFSM .62 IN 8.39
WTR YR 1988 TOTAL 12557.67 MEAN 34.3 MAX 162 MIN .08 CFSM .68 IN 9.21

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI
(National stream quality accounting network station)

LOCATION.--Lat 46°43'15", long 89°12'25", in NE1/4 sec , T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 150 ft downstream from bridge on Victoria Road, 1.8 mi southwest of Rockland, and 2.4 mi downstream from confluence of Middle and West Branches.

DRAINAGE AREA.--1,340 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1942 to current year.

REVISED RECORDS.--WSP 1387: 1943, 1946-47. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 638.72 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 23, 1943, nonrecording gage and Nov. 23, 1943 to Oct. 17, 1967, water-stage recorder at site 50 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Dec. 18 to Apr. 1. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated by Victoria powerplant on West Branch 5 mi upstream; Bond Falls Reservoir (station 04034000) 34 mi upstream; Lake Gogebic (station 04035995) and Cisco Lake (station 04037400), in headwaters.

AVERAGE DISCHARGE.--46 years, 1,415 ft^3/s, 14.34 in/yr.

EYTREMES FOR PERIOD OF RECORD.--Maximum discharge, 42,000 ft^3/s, Aug. 22, 1942, gage height, 28.6 ft, from floodmark, from rating curve extended above 14,000 ft^3/s on basis of slope-area measurement of peak flow; minimum daily, 192 ft^3/s, July 28, 29, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 9,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Apr. 6	2200	*12,800	*14.73	No other peak greater than base discharge.			

Minimum daily discharge, 232 ft^3/s, July 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	448	1070	2240	900	860	720	2800	640	657	304	294	476
2	646	917	1490	810	810	690	4270	629	631	267	529	342
3	977	1100	1200	800	740	700	7160	586	654	354	360	476
4	840	1070	1030	850	830	710	11200	577	537	402	595	408
5	704	1060	1120	860	790	710	11500	649	498	374	887	530
6	723	966	934	820	800	720	11900	780	576	350	607	538
7	1110	801	906	880	800	720	10400	736	619	345	597	579
8	1110	978	1100	930	780	750	8180	628	419	241	413	451
9	979	943	1900	920	750	760	7030	707	468	239	394	421
10	857	808	3530	900	830	780	5630	1290	475	232	370	622
11	731	773	2550	880	840	870	3960	1320	506	278	289	568
12	637	946	2100	920	810	800	3280	1210	479	265	372	550
13	637	812	1580	930	850	750	3010	1160	398	291	444	455
14	539	823	1260	920	760	740	2490	1110	396	282	2220	428
15	550	832	1330	930	870	730	2090	854	373	278	1470	468
16	2210	868	1300	970	790	680	1940	722	373	384	852	404
17	2070	1270	1040	940	850	750	1930	602	370	402	3050	461
18	1720	2550	1060	900	860	710	1710	726	328	341	2770	395
19	1400	2100	1000	950	840	710	1390	852	371	317	1650	631
20	1230	1520	1000	900	810	700	1080	708	378	309	1040	604
21	1310	1230	1000	820	780	680	1160	779	376	362	875	743
22	1170	821	1000	930	710	680	1150	622	324	348	827	816
23	1300	1050	970	920	800	700	1080	589	324	334	836	700
24	1360	1070	970	910	790	740	1010	388	294	404	777	745
25	1160	942	1000	840	920	1600	976	712	316	318	778	652
26	1140	888	840	900	870	3000	1040	668	324	348	802	659
27	1130	1010	840	880	870	3180	1010	854	360	307	754	660
28	1120	866	920	860	870	2700	990	694	243	271	715	594
29	1090	1560	930	870	870	2500	890	750	416	243	560	645
30	1050	2750	950	860	---	2400	800	653	436	293	598	615
31	990	---	1040	860	---	2600	---	692	---	263	413	---
TOTAL	32938	34394	40150	27560	23750	35480	113056	23887	12919	9746	27138	16636
MEAN	1063	1146	1295	889	819	1145	3769	771	431	314	875	555
MAX	2210	2750	3530	970	920	3180	11900	1320	657	404	3050	816
MIN	448	773	840	800	710	680	800	388	243	232	289	342

CAL YR 1987 TOTAL 324340 MEAN [illegible]99 MAX 4820 MIN 245 CFSM .66 IN 9.00
WTR YR 1988 TOTAL 397654 MEAN 1086 MAX 11900 MIN 232 CFSM .81 IN 11.04

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 15, 1975 to Sept. 30, 1977.

REMARKS.--Quarterly samples were collected at or near Victoria Road bridge. Daily record for water years 1975, 1978-81 is from once-daily observer samples.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-80): Maximum recorded (more than 20 percent missing record), 192 microsiemens, Mar. 26, 1977, May 28, 1978; minimum recorded, 45 microsiemens, Dec. 2, 1975.
WATER TEMPERATURE (water years 1975-77, 1979-80): Maximum, 28.0°C, July 19, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
27...	1130	1260	109	8.10	5.0	19	12.3	99	K22	K10
JAN										
12...	1330	1200	123	7.48	0.0	6.3	13.1	93	53	K21
APR										
12...	1545	2740	78	7.30	7.5	54	11.8	101	K11	K10
JUL										
20...	1500	492	190	8.30	22.5	14	8.3	99	K20	K15

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
27...	54	3	15	4.1	2.3	8	0.1	1.2	62	0
JAN										
12...	65	8	18	4.8	2.4	7	0.1	1.0	70	0
APR										
12...	38	9	11	2.5	1.4	7	0.1	1.2	35	0
JUL										
20...	91	1	25	6.8	3.1	7	0.1	1.1	109	0

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
OCT										
27...	51	11	2.1	0.10	8.5	88	0.12	299	<0.010	<0.100
JAN										
12...	57	13	2.9	0.20	8.8	97	0.13	314	0.020	0.100
APR										
12...	29	18	1.6	0.10	6.9	70	0.09	518	<0.010	0.110
JUL										
20...	89	6.4	2.0	0.10	8.3	113	0.15	150	<0.010	<0.100

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT										
27...	0.030	0.020	0.40	0.030	0.010	<0.010	110	<1	24	<0.5
JAN										
12...	0.030	0.030	0.40	0.010	0.010	<0.010	50	<1	26	<0.5
APR										
12...	0.070	0.060	0.50	0.030	0.020	0.020	160	<1	18	<0.5
JUL										
20...	<0.010	<0.010	0.40	0.040	0.010	<0.010	<10	1	36	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT										
27...	<1	<1	<3	1	210	<5	<4	11	<0.1	<10
JAN										
12...	<1	<1	<3	1	130	<5	4	6	<0.1	<10
APR										
12...	1	<1	<3	4	190	<5	<4	17	<0.1	<10
JUL										
20...	<1	1	<3	2	33	<5	<4	16	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT									
27...	<1	<1	<1.0	36	<6	<3	24	82	92
JAN									
12...	<1	<1	<1.0	36	<6	16	--	--	--
APR									
12...	<1	<1	<1.0	24	<6	3	91	673	93
JUL									
20...	3	<1	<1.0	60	<6	<3	27	36	93

04040500 STURGEON RIVER NEAR SIDNAW, MI

LOCATION.--Lat 46°35'03", long 88°34'33", in NE1/4 SE1/4 sec.5, T.48 N., R.34 W., Baraga County, Hydrologic Unit 04020104, on right bank 30 ft downstream from highway bridge, 3.0 mi downstream from Rock River, 3.5 mi northwest of Covington, 6.5 mi upstream from Perch River, 8.5 mi northeast of Sidnaw, and at mile 71.

DRAINAGE AREA.--171 mi².

PERIOD OF RECORD.--October 1912 to September 1915, April 1943 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1507: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,214.40 ft above National Geodetic Vertical Datum of 1929. October 1912 to September 1915, nonrecording gage at site 200 ft upstream at different datum. Apr. 2, 1943 to Oct. 1, 1946, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 3, 5, 6, 16-22, and Dec. 25 to Apr. 2. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--48 years, 215 ft³/s, 17.07 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,630 ft³/s, Apr. 24, 1960, gage height, 11.63 ft; minimum, 2.7 ft³/s, Sept. 13, 1976; minimum gage height, 2.97 ft, July 29, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,080 ft³/s, Apr. 8, gage height, 8.42 ft; minimum, 5.5 ft³/s, July 29, gage height, 2.97 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	68	193	330	115	83	55	305	226	69	10	8.5	81
2	131	183	298	100	81	55	400	210	57	9.3	22	71
3	233	177	260	97	78	55	714	192	50	7.9	81	67
4	244	190	228	95	76	55	1030	175	44	7.5	145	80
5	227	195	200	93	74	55	1280	160	40	6.8	216	105
6	267	186	185	92	72	55	1730	144	36	6.8	230	106
7	396	174	177	90	70	56	1990	132	34	6.6	169	96
8	398	164	171	85	68	70	2010	123	31	7.1	114	81
9	364	155	277	80	66	86	1860	126	30	6.7	81	71
10	320	143	408	76	65	105	1770	131	26	6.6	63	61
11	279	134	387	74	63	110	1560	126	24	6.3	50	52
12	240	127	353	75	62	110	1290	118	20	6.2	40	48
13	211	125	312	77	61	110	1120	148	19	6.3	68	46
14	187	118	281	79	60	105	994	167	20	6.4	268	44
15	196	113	246	83	60	105	868	158	19	7.6	124	40
16	478	118	240	90	61	102	734	139	17	13	86	38
17	521	255	235	98	62	98	661	125	16	11	458	47
18	482	451	232	100	64	96	619	113	15	12	467	53
19	405	429	230	100	66	95	552	101	17	12	381	56
20	333	341	227	99	68	94	478	90	18	10	284	67
21	297	311	224	99	68	92	414	91	16	9.4	203	87
22	284	326	220	99	66	90	363	89	15	8.2	154	89
23	276	250	198	98	64	90	334	96	14	7.6	138	90
24	259	231	179	98	62	92	328	86	13	7.1	127	82
25	254	215	170	97	60	175	314	76	12	7.8	123	75
26	243	202	160	96	59	400	303	71	12	6.9	138	100
27	250	189	150	92	57	340	297	74	12	6.6	139	180
28	259	176	145	88	56	272	284	93	12	6.3	129	186
29	245	250	140	86	55	260	264	103	13	5.8	118	163
30	228	347	135	85	---	300	242	106	11	7.2	105	146
31	207	---	130	85	---	305	---	85	---	9.1	92	---
TOTAL	8782	6468	7128	2821	1907	4088	25108	3874	732	248.1	4821.5	2508
MEAN	283	216	230	91.0	65.8	132	837	125	24.4	8.00	156	83.6
MAX	521	451	408	115	83	400	2010	226	69	13	467	186
MIN	68	113	130	74	55	55	242	71	11	5.8	8.5	38
CFSM	1.66	1.26	1.35	.53	.39	.77	4.90	.73	.14	.05	.91	.49
IN.	1.91	1.41	1.55	.61	.41	.89	5.46	.84	.16	.05	1.05	.55

CAL YR 1987 TOTAL 59852.0 MEAN 164 MAX 963 MIN 16 CFSM .96 IN 13.02
WTR YR 1988 TOTAL 68485.6 MEAN 187 MAX 2010 MIN 5.8 CFSM 1.09 IN 14.90

04041500 STURGEON RIVER NEAR ALSTON, MI

LOCATION.--Lat 46°43'35", long 88°39'43", in SE1/4 sec.15, T.50 N., R.35 W., Baraga County, Hydrologic Unit 04020104, on right bank in powerhouse of Upper Peninsula Power Co. at Prickett Dam, 4.0 mi upstream from Clear Creek, 5.0 mi southeast of Alston, and at mile 45.

DRAINAGE AREA.--346 mi².

PERIOD OF RECORD.--February 1932 to June 1941, October 1942 to current year. Monthly discharge only for some periods, published in WSP 1307.

GAGE.--Water-stage recorder. Datum of gage is 710.3 ft mean tide at New York City datum (levels by U.S. Army Corps of Engineers). Prior to Jan. 5, 1948, nonrecording gage and Jan. 5, 1948 to Sept. 30, 1963, water-stage recorder at same site at datum 40.00 ft lower.

REMARKS.--Estimated daily discharges: Jan. 14, 17, and Feb. 6-29. Records good. Flow regulated by powerplant at station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--54 years (water years 1933-40, 1943-88), 421 ft³/s, 16.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,360 ft³/s, Apr. 24, 1960, gage height, 13.09 ft, present datum; minimum daily, 1 ft³/s, Aug. 14-19, 1960.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,130 ft³/s, Apr. 7, gage height, 8.20 ft; minimum daily, 16 ft³/s, June 25, 26, July 2-4, 10, 24, 31, Sept. 17, 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	216	366	656	280	217	324	683	425	178	107	118	217
2	222	367	656	280	226	187	726	387	249	16	196	216
3	220	366	437	279	224	206	1320	374	274	16	218	217
4	269	319	441	282	228	205	2170	374	223	16	224	218
5	274	319	443	278	225	209	2220	320	225	111	264	204
6	375	318	440	277	221	308	2510	318	197	119	329	204
7	415	317	399	225	221	307	2970	267	198	108	327	205
8	630	316	387	225	221	306	2800	267	197	119	329	205
9	633	317	422	230	220	303	2570	267	194	17	276	204
10	634	317	645	229	220	255	2400	267	196	16	198	206
11	620	270	645	228	220	252	2130	267	67	169	199	17
12	426	204	644	229	219	218	1730	269	52	112	197	207
13	318	192	646	219	218	301	1580	271	170	106	145	207
14	324	275	643	218	216	300	1410	269	171	114	473	205
15	334	274	439	216	218	299	1280	274	170	164	628	206
16	811	277	440	225	217	298	1000	321	119	120	275	204
17	1020	279	437	220	217	296	997	323	107	120	441	16
18	742	437	398	215	200	295	836	274	22	120	600	16
19	641	646	385	218	166	295	871	133	48	119	640	196
20	639	651	385	224	166	292	816	202	119	120	521	196
21	638	651	383	214	167	295	534	186	119	120	635	196
22	623	646	384	208	167	293	630	225	119	120	625	196
23	429	445	357	223	167	292	630	200	122	119	518	172
24	430	446	356	225	167	292	565	202	118	16	324	195
25	412	445	356	221	168	349	628	248	16	120	222	195
26	429	406	276	217	226	675	616	203	16	120	223	221
27	428	392	280	224	333	492	421	195	120	121	224	221
28	579	390	280	224	329	640	387	225	106	121	221	295
29	367	431	215	215	325	627	372	226	118	120	223	319
30	412	658	279	207	---	544	426	225	118	17	242	318
31	372	---	282	211	---	644	---	225	---	16	217	---
TOTAL	14882	11737	13436	7186	6329	10599	38228	8229	4148	2919	10272	5894
MEAN	480	391	433	232	218	342	1274	265	138	94.2	331	196
MAX	1020	658	656	282	333	675	2970	425	274	169	640	319
MIN	216	192	215	207	166	187	372	133	16	16	118	16
CFSM	1.39	1.13	1.25	.67	.63	.99	3.68	.77	.40	.27	.96	.57
IN.	1.60	1.26	1.44	.77	.68	1.14	4.11	.88	.45	.31	1.10	.63

CAL YR 1987 TOTAL 121571 MEAN 333 MAX 1120 MIN 14 CFSM .96 IN 13.07
WTR YR 1988 TOTAL 133859 MEAN 366 MAX 2970 MIN 16 CFSM 1.06 IN 14.39

04043050 TRAP ROCK RIVER NEAR LAKE LINDEN, MI

LOCATION.--Lat 47°13'43", long 88°23'07", in SE1/4 SE1/4 sec.20, T.56 N., R.32 W., Houghton County, Hydrologic Unit 04020103, on right bank 20 ft upstream from bridge on county highway, 2.0 mi northeast of Lake Linden, and 3.0 mi upstream from mouth.

DRAINAGE AREA.--28.0 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Datum of gage is 621.7 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Oct. 10-15, 18-27, Nov. 20, 21, Dec. 6, 26, 28, 30, Jan. 1 to Feb. 19, 21, 22, and Mar. 13-15, 17, 20. Records good except for estimated daily discharges, which are fair. Small diversions for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 46.3 ft³/s, 22.46 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,590 ft³/s, May 10, 1979, gage height, 10.72 ft; minimum daily, 6.8 ft³/s, Oct. 3, 1976; minimum gage height, 3.75 ft, July 22, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 380 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Apr. 6	unknown	696	8.32	Aug. 17	1400	*1,170	*9.95

Minimum discharge, 9.6 ft³/s, July 22, gage height, 3.75 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	17	27	79	21	19	19	63	64	23	12	11	21
2	23	29	60	23	19	20	74	56	21	12	12	22
3	27	32	50	23	18	19	119	49	19	12	14	21
4	22	39	43	22	18	19	238	45	18	12	23	25
5	21	37	38	21	18	19	352	43	18	11	24	26
6	47	33	30	20	18	20	490	38	17	11	26	23
7	70	32	33	20	18	21	482	35	17	11	22	21
8	46	31	32	20	17	23	393	35	17	11	18	19
9	34	29	71	20	17	29	291	41	23	11	15	18
10	28	28	140	21	17	31	331	39	18	11	14	17
11	24	26	84	21	17	31	279	33	16	11	12	17
12	23	27	64	22	17	28	271	34	15	11	12	16
13	21	29	58	22	17	27	298	111	15	12	108	17
14	19	28	49	23	18	26	281	70	15	12	198	17
15	18	28	44	23	18	26	147	56	14	13	73	16
16	63	34	40	22	19	25	120	45	15	14	86	15
17	84	94	35	22	19	25	157	38	15	13	733	17
18	46	128	33	20	20	24	128	34	14	12	193	17
19	35	77	33	20	21	24	104	31	15	11	75	16
20	28	50	33	20	21	23	93	28	15	11	50	18
21	44	43	32	20	21	23	84	28	14	11	37	21
22	41	32	31	20	21	23	81	27	14	11	30	21
23	50	30	30	20	21	23	83	25	13	11	70	21
24	80	30	28	20	21	23	87	24	14	11	64	19
25	77	28	29	20	21	46	86	22	21	11	50	18
26	51	26	28	20	21	72	89	23	18	11	57	21
27	57	25	28	20	20	74	85	50	15	11	41	33
28	46	26	27	20	19	68	75	63	15	11	34	25
29	38	83	27	20	19	59	69	39	13	10	28	22
30	33	128	27	20	---	58	66	31	13	13	24	22
31	28	---	25	20	---	60	---	26	---	12	22	---
TOTAL	1241	1289	1361	646	550	1008	5516	1283	490	357	2176	602
MEAN	40.0	43.0	43.9	20.8	19.0	32.5	184	41.4	16.3	11.5	70.2	20.1
MAX	84	128	140	23	21	74	490	111	23	14	733	33
MIN	17	25	25	20	17	19	63	22	13	10	11	15
CFSM	1.43	1.54	1.57	.74	.68	1.16	6.57	1.48	.58	.41	2.51	.72
IN.	1.65	1.71	1.81	.86	.73	1.34	7.33	1.70	.65	.47	2.89	.80

CAL YR 1987 TOTAL 13326 MEAN 36.5 MAX 222 MIN 12 CFSM 1.30 IN 17.70
WTR YR 1988 TOTAL 16519 MEAN 45.1 MAX 733 MIN 10 CFSM 1.61 IN 21.95

04044609 SAND RIVER WILDLIFE FLOODING AT SAND RIVER, MI

LOCATION.--Lat 46°29'14", long 87°07'30", in SW1/4 NE1/4 sec.12, T.47 N., R.23 W., Marquette County, Hydrologic Unit 04020201, on right bank at dam at Sand River, 1.2 miles upstream from mouth.

DRAINAGE AREA.--28.6 mi². Area of Sand River Wildlife Flooding is 0.6 mi².

PERIOD OF RECORD.--October 1983 to current year (gage heights only).

GAGE.--Water-stage recorder. Datum of gage is 600.0 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Natural Resources bench mark).

REMARKS.--Pond level regulated by concrete dam with two 20-foot stop-log bays and a 20-foot radial gate. Gage-height telemeter at station.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 11.51 ft, Apr. 20, 1985; minimum, 5.64 ft, Apr. 20, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 9.98 ft, Apr. 7; minimum, 5.64 ft, Apr. 20.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.04	8.87	9.10	7.70	7.40	7.36	7.98	8.13	7.33	7.06	6.86	7.95
2	8.04	8.87	8.71	7.62	7.40	7.36	7.81	8.11	7.30	7.06	6.91	7.87
3	8.10	8.88	8.47	7.56	7.38	7.35	8.16	8.08	7.28	7.06	7.30	7.85
4	8.15	8.89	8.34	7.50	7.38	7.35	8.83	8.03	7.26	7.06	7.40	8.19
5	8.21	8.86	8.25	7.43	7.38	7.35	9.17	7.98	7.25	7.04	7.72	8.51
6	8.25	8.87	8.17	7.38	7.38	7.36	9.59	7.93	7.24	7.02	7.92	8.60
7	8.30	8.87	6.09	7.35	7.37	7.38	9.74	7.89	7.23	6.99	7.94	8.53
8	8.40	8.86	8.06	7.33	7.36	7.41	9.08	7.87	7.22	6.97	7.87	8.39
9	8.49	8.85	8.18	7.32	7.36	7.52	8.54	7.86	7.22	6.97	7.78	8.27
10	8.53	8.83	8.65	7.31	7.36	7.57	8.07	7.82	7.22	6.96	7.60	8.16
11	8.57	8.82	8.80	7.30	7.35	7.64	7.55	7.80	7.22	6.95	7.57	8.07
12	8.60	8.84	8.73	7.31	7.35	7.71	7.00	7.80	7.21	6.94	7.50	8.11
13	8.63	8.84	8.61	7.31	7.35	7.74	6.61	7.89	7.21	6.93	7.48	8.20
14	8.66	8.83	8.50	7.31	7.35	7.74	6.35	8.01	7.19	6.92	7.64	8.27
15	8.67	8.82	8.41	7.32	7.35	7.73	6.09	8.10	7.17	6.95	7.72	8.31
16	8.68	8.83	8.36	7.34	7.35	7.69	5.93	8.15	7.16	6.98	7.83	8.36
17	8.70	8.92	8.29	7.35	7.35	7.65	5.84	8.20	7.15	6.97	8.25	8.41
18	8.72	9.14	8.22	7.36	7.35	7.63	5.82	8.25	7.16	6.97	8.60	8.45
19	8.74	9.39	8.18	7.36	7.36	7.62	5.74	8.29	7.15	6.96	8.58	8.52
20	8.76	9.57	8.15	7.40	7.38	7.59	6.14	8.31	7.13	6.95	8.00	8.56
21	8.75	9.68	8.10	7.39	7.37	7.53	7.21	8.32	7.12	6.94	7.33	8.61
22	8.75	9.70	8.07	7.39	7.38	7.51	7.66	8.34	7.11	6.92	6.80	8.68
23	8.77	9.71	8.03	7.39	7.38	7.50	7.90	8.33	7.10	6.91	7.11	8.74
24	8.78	9.75	8.00	7.40	7.37	7.49	8.07	8.08	7.11	6.90	7.45	8.77
25	8.81	9.76	8.00	7.40	7.37	7.76	8.16	7.88	7.13	6.90	7.65	8.79
26	8.84	9.76	7.95	7.40	7.37	8.04	8.18	7.73	7.11	6.89	7.88	8.83
27	8.83	9.74	7.92	7.40	7.37	8.18	8.17	7.62	7.11	6.89	8.01	8.93
28	8.85	9.72	7.88	7.40	7.37	8.28	8.16	7.54	7.11	6.88	8.07	9.01
29	8.87	9.76	7.83	7.40	7.37	8.37	8.18	7.47	7.09	6.86	8.09	9.08
30	8.87	9.76	7.77	7.40	---	8.49	8.16	7.40	7.07	6.87	8.06	9.16
31	8.87	---	7.75	7.40	---	8.45	---	7.37	---	6.87	8.01	---
MEAN	8.59	9.20	8.24	7.39	7.37	7.69	7.66	7.95	7.18	6.95	7.71	8.47
MAX	8.87	9.76	9.10	7.70	7.40	8.49	9.74	8.34	7.33	7.06	8.60	9.16
MIN	8.04	8.82	7.75	7.30	7.35	7.35	5.74	7.37	7.07	6.86	6.80	7.85

WTR YR 1988 MEAN 7.87 MAX 9.76 MIN 5.74

04045500 TAHQUAMENON RIVER NEAR TAHQUAMENON PARADISE, MI
(National stream quality accounting network station)

LOCATION.--Lat 46°34'30", long 85°16'10", in NE1/4 sec.11, T.48 N., R.8 W., Luce County, Hydrologic Unit 04020202, on left bank 0.7 mi upstream from Tahquamenon (Big) Falls, 11.5 mi west of Tahquamenon Paradise, and 19 mi northeast of Newberry.

DRAINAGE AREA.--790 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1953 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 697 ft from river-profile map.

REMARKS.--No estimated daily discharges. Water-discharge records good.

AVERAGE DISCHARGE.--35 years, 927 ft³/s, 15.93 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,990 ft³/s, May 10, 1960, gage height, 10.26 ft; minimum, 157 ft³/s, July 26, 1955, July 8, 1988; minimum gage height, 2.75 ft, July 8, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,620 ft³/s, Apr. 9, 10, gage height, 9.42 ft; minimum, 157 ft³/s, July 8, gage height, 2.75 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	479	754	1250	627	485	409	1180	1360	337	191	207	658
2	555	728	1280	605	522	403	1340	1250	341	189	234	625
3	712	703	1240	573	547	396	1690	1140	334	189	241	596
4	789	705	1250	547	556	394	2170	1030	327	186	247	595
5	813	735	1220	527	562	393	2820	927	314	181	270	615
6	811	794	1130	499	562	391	3800	841	301	176	280	623
7	795	827	1050	477	551	391	4740	779	287	174	297	624
8	806	828	977	460	534	401	5280	706	269	165	291	605
9	783	851	1010	447	515	430	5520	647	255	166	281	566
10	750	835	1220	435	498	462	5580	602	252	171	280	523
11	717	820	1340	417	481	487	5530	604	245	175	274	491
12	674	780	1430	403	463	510	5460	580	243	179	263	462
13	639	751	1490	396	447	520	5320	624	234	192	261	458
14	598	735	1510	394	432	519	5090	729	228	191	308	451
15	558	719	1410	389	427	518	4890	750	209	212	328	452
16	535	701	1210	388	425	518	4660	741	205	231	352	437
17	546	762	1190	389	418	519	4430	728	206	270	418	413
18	655	860	1180	402	414	524	4150	699	209	279	513	400
19	731	954	1160	416	411	525	3930	645	207	274	573	401
20	774	995	1130	431	408	525	3680	594	201	264	586	455
21	797	994	1110	437	414	521	3440	541	214	254	571	536
22	809	1000	1050	440	410	516	3170	501	210	241	553	611
23	817	1020	1010	439	408	506	2910	464	212	238	522	659
24	819	1080	961	440	408	508	2690	421	219	232	505	693
25	819	1120	919	438	411	558	2490	401	210	221	512	695
26	817	1090	872	442	409	697	2230	385	214	217	535	700
27	798	1070	824	440	408	791	2010	366	218	219	570	730
28	809	1060	774	429	410	845	1800	363	208	210	611	751
29	808	1050	727	424	404	912	1630	361	202	205	639	759
30	795	1130	687	419	---	984	1480	349	194	193	660	748
31	783	---	650	437	---	1060	---	344	---	200	666	---
TOTAL	22591	26451	34261	14007	13340	17133	105110	20472	7305	6485	12848	17332
MEAN	729	882	1105	452	460	553	3504	660	244	209	414	578
MAX	819	1130	1510	627	562	1060	5580	1360	341	279	666	759
MIN	479	701	650	388	404	391	1180	344	194	165	207	400
CFSM	.92	1.12	1.40	.57	.58	.70	4.44	.84	.31	.27	.52	.73
IN.	1.06	1.25	1.61	.66	.63	.81	4.95	.96	.34	.31	.60	.82

CAL YR 1987 TOTAL 254604 MEAN 698 MAX 2140 MIN 263 CFSM .88 IN 11.99
WTR YR 1988 TOTAL 297335 MEAN 812 MAX 5580 MIN 165 CFSM 1.03 IN 14.00

04045500 TAHQUAMENON RIVER NEAR TAHQUAMENON PARADISE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1973 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 1, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected during the year at cableway 40 ft downstream or at wading section 600 ft downstream from gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1976-77, 1979-81): Maximum recorded (more than 20 percent missing record), 238 microsiemens, Jan. 24, 1977; minimum, 34 microsiemens, Apr. 17, 18, 1976.
WATER TEMPERATURE (water years 1976-77, 1979-81): Maximum, 26.5°C, May 21, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
22...	0910	810	134	7.60	6.5	2.5	9.2	77	K11	110
JAN										
12...	1330	401	152	7.50	0.0	2.1	--	--	180	210
APR										
07...	1130	4640	42	7.20	0.5	3.2	10.4	74	<7	K20
JUL										
13...	1345	190	196	8.10	21.0	1.4	7.1	83	K5	K6

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
22...	72	20	20	5.3	1.9	5	0.1	0.80	63	0
JAN										
12...	76	16	21	5.6	2.0	5	0.1	0.70	73	0
APR										
07...	20	8	5.4	1.6	0.80	8	0.1	0.80	15	0
JUL										
13...	100	15	28	7.8	2.4	5	0.1	0.60	106	0

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
OCT										
22...	52	14	1.9	0.10	7.3	111	0.15	243	<0.010	<0.100
JAN										
12...	60	16	3.2	0.10	9.5	108	0.15	117	0.020	0.110
APR										
07...	12	--	1.4	0.10	4.5	36	--	--	<0.010	0.170
JUL										
13...	87	17	1.9	0.10	5.5	118	0.16	60.5	<0.010	<0.100

04045500 TAHQUAMENON RIVER NEAR TAHQUAMENON PARADISE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)
OCT										
22...	0.060	0.050	0.70	0.020	0.040	0.020	80	<1	20	<0.5
JAN										
12...	0.050	0.050	0.40	0.010	0.010	<0.010	50	1	20	<0.5
APR										
07...	0.070	0.060	0.80	0.030	0.010	0.030	140	<1	11	<0.5
JUL										
13...	0.020	0.010	<0.20	0.020	<0.010	0.020	20	1	27	<0.5

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)
OCT										
22...	<1	<1	<3	1	360	<5	<4	18	<0.1	<10
JAN										
12...	<1	<1	<3	1	390	<5	<4	39	<0.1	<10
APR										
07...	<1	<1	<3	2	280	<5	13	31	<0.1	<10
JUL										
13...	1	<1	<3	1	31	<5	7	3	<0.1	<10

DATE	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT									
22...	<1	<1	<1.0	48	<6	66	5	11	94
JAN									
12...	2	<1	<1.0	47	<6	30	3	3.2	83
APR									
07...	3	<1	1.0	13	<6	17	22	276	85
JUL									
13...	4	<1	1.0	64	<6	11	4	2.1	90

04045580 ST. MARYS RIVER ABOVE SAULT STE. MARIE, MI
(National stream quality accounting network and radiochemical station)

LOCATION.--Lat 46°29'29", long 84°25'17", in NW1/4 sec.10, T.47 N., R.1 W., Chippewa County, Hydrologic Unit 04020300, at Sault Ste. Marie municipal raw-water intake at Big Point, 2.6 mi west of the International Bridge, at Sault Ste. Marie.

DRAINAGE AREA.--80,900 mi², approximately.

PERIOD OF RECORD.--Water years 1970 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: March 1974 to September 1981.
WATER TEMPERATURE: March 1974 to September 1981.

REMARKS.--Quarterly samples were collected at the raw-water tap in Sault Ste. Marie municipal water plant at Big Point. Intake is 1,500 ft from water plant at a depth of 30 ft, 10 ft above bottom of channel. Prior to the 1983 water year, water temperatures were measured at the raw-water tap. Since 1983, water temperatures have been measured in the stream near the water plant, and therefore, are not comparable with those in "EXTREMES FOR PERIOD OF DAILY RECORD."

COOPERATION.--Discharges are monthly means provided by U.S. Army Corps of Engineers, Sault Ste. Marie.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-81): Maximum daily, 113 microsiemens, Oct. 26, 1980; minimum daily, 76 microsiemens, Apr. 24, 1975.
WATER TEMPERATURE (water years 1975-81): Maximum daily, 24.0°C, July 25, 1979; minimum daily, 0.0°C, Mar. 14, 15, 1974, Feb. 1, 1979.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A water temperature of 27.0°C was measured July 12, 1988.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
21...	0930	59300	96	7.90	6.5	0.40	11.2	94	K2	K3
JAN										
13...	0840	63200	95	7.60	0.0	0.30	--	--	<1	<1
APR										
06...	0800	63200	95	7.80	0.5	1.2	13.6	99	K2	K7
JUL										
12...	1500	55800	98	8.04	27.0	0.40	8.5	110	K2	K3

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
21...	47	5	14	2.9	1.5	6	0.1	0.60	51	0
JAN										
13...	47	4	14	2.9	1.6	7	0.1	0.60	52	0
APR										
06...	44	6	13	2.8	1.4	6	0.1	0.60	46	0
JUL										
12...	44	2	13	2.8	1.5	7	0.1	0.50	51	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
21...	42	3.9	2.0	0.10	2.4	52	0.07	8330	<0.010	0.260
JAN										
13...	43	4.5	2.0	0.10	2.5	61	0.08	10400	0.020	0.300
APR										
06...	38	4.5	1.6	0.10	2.6	55	0.07	9390	<0.010	0.300
JUL										
12...	42	4.1	1.2	<0.10	2.2	52	0.07	7830	<0.010	0.360

04045580 ST. MARYS RIVER ABOVE SAULT STE. MARIE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 21...	0.010	0.010	<0.20	0.050	<0.010	0.010	<10	<1	12	<0.5
JAN 13...	<0.010	<0.010	<0.20	<0.010	<0.010	<0.010	<10	2	13	<0.5
APR 06...	0.030	0.010	<0.20	0.010	<0.010	<0.010	<10	<1	12	<0.5
JUL 12...	<0.010	<0.010	<0.20	<0.010	<0.010	<0.010	<10	1	12	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 21...	<1	4	<3	3	5	6	<4	<1	<0.1	<10
JAN 13...	<1	<1	<3	3	9	<5	<4	1	<0.1	<10
APR 06...	<1	<1	<3	5	31	<5	<4	2	<0.1	<10
JUL 12...	<1	<1	<3	3	<3	<5	<4	<1	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	GROSS ALPHA, DISSOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DISSOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)
OCT 21...	<1	<1	<1.0	23	<6	53	<0.4	<0.4	1.1	<0.4
JAN 13...	<1	<1	1.0	26	<6	120	--	--	--	--
APR 06...	1	<1	<1.0	22	<6	92	--	--	--	--
JUL 12...	<1	<1	<1.0	23	<6	46	<0.4	<0.4	1.0	<0.4

DATE	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	URANIUM NATURAL DISSOLVED (UG/L AS U)
OCT 21...	1.0	<0.4	0.03	0.04
JAN 13...	--	--	--	--
APR 06...	--	--	--	--
JUL 12...	0.9	<0.4	0.02	0.04

04047200 MANISTIQUE LAKE NEAR CURTIS, MI

LOCATION.--Lat 46°14'47", long 85°51'06", in SW1/4 SE1/4 sec.31, T.45 N., R.12 W., Luce County, Hydrologic Unit 04060106, at lake outlet, 5.8 mi northwest of Curtis.

DRAINAGE AREA.--118 mi², approximately.

PERIOD OF RECORD.--April 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 683.08 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Apr. 15, 1943 and Oct. 1, 1968 to Oct. 4, 1976, nonrecording gage at same datum.

REMARKS.--Lake level controlled by concrete dam with removable flash boards constructed in 1978 on the outlet, and by a dam on Portage Creek, one of the inlets. From 1948 to 1978 lake level controlled by timber dam with removable flash boards on outlet. Occasionally during periods of high flow, backwater from Fox River raises the lake level. Major inlets to Manistique Lake are Helmer Creek from North Manistique Lake, Portage Creek from South Manistique Lake, and Fork Lake Outlet. The outlet is Manistique River. Streamflow records were collected for South Manistique Lake Outlet (station 04046500) from May 1942 to September 1944, for North Manistique Lake Outlet (station 04047000) from August 1942 to September 1944, and for Manistique River (station 04047500) from Apr. 1942 to June 1950. Established legal level; 686.00 ft above NGVD, established by Circuit Court, January 1948. Surface area of lake is 10,100 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 6.28 ft, May 14, 15 or 16, 1960, from floodmark; minimum, 1.33 ft, Aug. 10, 1948, result of dam construction.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.79 ft, Apr. 20; minimum daily, 2.60 ft, Mar. 23-25.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.96	2.85	2.89	2.98	2.81	2.67	2.66	3.60	3.35	2.74	2.82	3.48
2	2.97	2.84	2.87	2.97	2.80	2.66	2.68	3.58	3.33	2.74	2.82	3.49
3	3.00	2.82	2.91	2.96	2.80	2.66	2.75	3.56	3.29	2.74	2.81	3.53
4	3.00	2.80	2.89	2.94	2.79	2.65	2.81	3.55	3.28	2.74	2.81	3.54
5	2.97	2.76	2.89	2.95	2.78	2.64	2.89	3.57	3.25	2.72	2.86	3.48
6	2.95	2.82	2.88	2.95	2.78	2.63	3.02	3.57	3.24	2.71	2.81	3.47
7	2.94	2.82	2.87	2.95	2.78	2.62	3.19	3.58	3.25	2.69	2.85	3.47
8	2.95	2.79	2.87	2.93	2.79	2.63	3.31	3.54	3.21	2.66	2.84	3.44
9	2.89	2.79	2.91	2.92	2.79	2.63	3.43	3.53	3.14	2.67	2.87	3.41
10	2.91	2.79	2.93	2.92	2.78	2.62	3.52	3.47	3.12	2.68	2.88	3.39
11	2.90	2.77	2.94	2.91	2.77	2.62	3.60	3.50	3.11	2.68	2.86	3.40
12	2.89	2.77	2.95	2.91	2.76	2.63	3.67	3.49	3.08	2.68	2.85	3.36
13	2.87	2.76	2.96	2.90	2.76	2.66	3.71	3.38	3.07	2.66	2.85	3.36
14	2.86	2.75	2.96	2.90	2.76	2.66	3.73	3.51	3.05	2.65	2.82	3.32
15	2.87	2.77	2.97	2.90	2.78	2.66	3.75	3.48	2.98	2.68	2.88	3.33
16	2.87	2.76	3.01	2.90	2.77	2.65	3.76	3.47	2.99	2.89	2.88	3.33
17	2.87	2.81	3.01	2.88	2.76	2.64	3.74	3.46	2.98	2.92	3.10	3.29
18	2.89	2.80	3.02	2.87	2.76	2.64	3.67	3.44	2.95	2.92	3.25	3.28
19	2.90	2.79	3.03	2.86	2.75	2.64	3.74	3.43	2.90	2.92	3.24	3.32
20	2.89	2.79	3.05	2.88	2.74	2.63	3.75	3.42	2.92	2.92	3.25	3.29
21	2.88	2.85	3.05	2.89	2.73	2.63	3.73	3.41	2.97	2.91	3.26	3.29
22	2.91	2.85	3.04	2.88	2.73	2.62	3.73	3.38	2.93	2.90	3.28	3.31
23	2.88	2.83	3.04	2.87	2.71	2.60	3.75	3.36	2.94	2.91	3.33	3.27
24	2.86	2.84	3.03	2.87	2.70	2.60	3.72	3.32	2.93	2.89	3.33	3.30
25	2.86	2.87	3.03	2.86	2.70	2.60	3.73	3.31	2.80	2.87	3.34	3.26
26	2.85	2.85	3.03	2.85	2.69	2.61	3.69	3.31	2.84	2.86	3.40	3.30
27	2.85	2.84	3.01	2.84	2.68	2.61	3.70	3.31	2.84	2.87	3.44	3.28
28	2.86	2.83	3.00	2.83	2.68	2.61	3.65	3.31	2.83	2.85	3.45	3.30
29	2.86	2.85	2.99	2.83	2.68	2.64	3.64	3.31	2.78	2.82	3.46	3.28
30	2.83	2.88	2.98	2.82	---	2.65	3.62	3.30	2.77	2.79	3.49	3.24
31	2.85	---	2.98	2.82	---	2.66	---	3.30	---	2.81	3.50	---
MEAN	2.90	2.81	2.97	2.89	2.75	2.63	3.48	3.44	3.04	2.79	3.08	3.36
MAX	3.00	2.88	3.05	2.98	2.81	2.67	3.76	3.60	3.35	2.92	3.50	3.54
MIN	2.83	2.75	2.87	2.82	2.68	2.60	2.66	3.30	2.77	2.65	2.81	3.24

WTR YR 1988 MEAN 3.01 MAX 3.76 MIN 2.60

04056500 MANISTIQUE RIVER NEAR MANISTIQUE, MI

LOCATION.--Lat 46°01'50", long 86°09'40", in SE1/4 sec.15, T.42 N., R.15 W., Schoolcraft County, Hydrologic Unit 04060106, on left bank 1.0 mi downstream from West Branch, 6.0 mi northeast of Manistique, and at mile 19.5.

DRAINAGE AREA.--1,100 mi², approximately.

PERIOD OF RECORD.--March 1938 to current year.

REVISED RECORDS.--WSP 1387: 1940-42(M), 1943, 1945. WSP 1627, 1727: 1938, 1939.

GAGE.--Water-stage recorder. Elevation of gage is 608 ft, from river-profile map. Prior to July 15, 1939, non-recording gage at site 1,600 ft upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 5, 6, and Dec. 18 to Apr. 4. Records good except for estimated daily discharges, which are fair. Since July 1948, slight regulation by dam on outlet of Manistique Lake. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--50 years, 1,432 ft³/s, 17.68 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 16,900 ft³/s, May 11, 1960, gage height, 12.85 ft; minimum, 288 ft³/s, Oct. 4, 1948; minimum gage height, 1.01 ft, Aug. 23, 1941.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,770 ft³/s, Apr. 9, gage height, 11.55 ft; minimum, 378 ft³/s, July 9; minimum gage height, 2.33 ft, Aug. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	573	1090	1710	1020	870	780	2200	1950	784	486	423	1260
2	649	1050	1840	990	890	766	2700	1860	757	475	428	1150
3	723	1020	1700	960	890	766	3400	1770	733	466	460	1060
4	784	1030	1550	930	880	766	4300	1680	710	437	452	1030
5	825	1070	1450	900	860	760	4950	1580	697	418	443	1060
6	831	1110	1450	870	840	760	6110	1430	673	406	458	1100
7	817	1120	1430	860	820	770	7870	1340	659	395	514	1060
8	803	1120	1440	840	800	810	9380	1270	651	386	549	1010
9	809	1110	1590	830	790	860	9560	1220	638	385	540	953
10	813	1070	1730	830	780	910	8850	1170	618	403	509	908
11	798	1040	1940	820	780	950	8130	1120	606	434	480	870
12	780	1000	2100	810	780	970	7430	1080	595	460	459	841
13	761	976	2190	810	780	970	6730	1080	579	461	447	871
14	741	957	2200	810	780	950	6020	1070	563	443	471	928
15	725	941	2150	810	780	930	5290	1090	547	424	480	1010
16	713	931	2050	820	780	930	4730	1070	533	527	605	1020
17	734	1010	1880	830	780	930	4380	1030	521	714	845	967
18	780	1280	1800	850	780	920	4060	991	516	765	1200	915
19	832	1500	1770	870	780	920	3730	954	510	718	1480	891
20	864	1620	1740	880	780	920	3400	920	517	648	1540	969
21	858	1590	1700	886	780	920	3170	892	594	593	1510	1110
22	864	1530	1650	870	780	920	2910	872	641	556	1410	1180
23	883	1600	1600	860	770	930	2700	846	622	518	1240	1220
24	913	1630	1530	860	770	950	2570	824	583	497	1160	1220
25	953	1650	1500	860	770	980	2460	791	573	479	1140	1160
26	973	1640	1450	850	770	1150	2370	779	560	465	1210	1100
27	1000	1510	1350	840	780	1300	2290	781	549	458	1390	1090
28	1050	1500	1250	830	780	1500	2220	787	535	446	1480	1110
29	1100	1440	1170	830	780	1600	2140	794	513	433	1500	1120
30	1120	1520	1120	830	---	1700	2040	791	498	444	1450	1090
31	1120	---	1060	840	---	1900	---	786	---	433	1360	---
TOTAL	26189	37655	51090	26696	23200	31188	138090	34618	18075	15173	27633	31273
MEAN	845	1255	1648	861	800	1006	4603	1117	603	489	891	1042
MAX	1120	1650	2200	1020	890	1900	9560	1950	784	765	1540	1260
MIN	573	931	1060	810	770	760	2040	779	498	385	423	841
CFSM	.77	1.14	1.50	.78	.73	.92	4.19	1.02	.55	.45	.81	.95
IN.	.89	1.27	1.73	.90	.78	1.05	4.67	1.17	.61	.51	.93	1.06

CAL YR 1987 TOTAL 353817 MEAN 969 MAX 2590 MIN 448 CFSM .88 IN 11.97
WTR YR 1988 TOTAL 460880 MEAN 1259 MAX 9560 MIN 385 CFSM 1.15 IN 15.59

04057000 INDIAN LAKE NEAR MANISTIQUE, MI

LOCATION.--Lat 45°59'30", long 86°17'15", in SW1/4 NE1/4 sec.34, T.42 N., R.16 W., Schoolcraft County, Hydrologic Unit 04060106, on east shore, just upstream from highway bridge over outlet of Indian Lake, 2.0 mi northwest of Manistique.

DRAINAGE AREA.--302 mi^2.

PERIOD OF RECORD.--March 1938 to current year.

GAGE.--Water-stage recorder. Datum of gage is 608.66 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 9, 1942, nonrecording gage at site 0.5 mi northwest at same datum.

REMARKS.--Indian Lake is regulated by two vertical lift gates in concrete and earth-fill dam 1.5 mi downstream from lake on outlet. Major inlets to Indian Lake are Silver Creek, Dufour Creek, Indian River, Dead Creek, Smith Creek and Big Spring. Streamflow records for Indian River (station 04057000), at lake outlet, were collected from March 1938 to September 1971; annual peak discharge 1972-82. Established legal level; 613.27 ft, above NGVD. Surface area of lake is 8,660 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 7.79 ft, June 24, 1943; minimum daily, 3.01 ft, Feb. 20, 1948.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.95 ft, Aug. 25; minimum, 3.12 ft, Mar. 6, 8, 12.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.43	4.35	4.01	3.77	3.32	3.16	3.52	4.13	4.14	3.63	4.10	4.76
2	4.47	4.32	4.03	3.74	3.30	3.16	3.57	4.11	4.10	3.61	4.11	4.72
3	4.46	4.32	4.04	3.71	3.30	3.15	3.70	4.14	4.10	3.60	4.12	4.73
4	4.47	4.36	4.02	3.67	3.30	3.15	3.83	4.16	4.09	3.59	4.14	4.73
5	4.48	4.39	4.01	3.66	3.30	3.14	4.00	4.17	4.07	3.58	4.21	4.72
6	4.52	4.37	3.99	3.63	3.29	3.13	4.27	4.17	4.06	3.58	4.23	4.69
7	4.51	4.33	3.97	3.59	3.28	3.13	4.48	4.16	4.04	3.57	4.21	4.66
8	4.50	4.30	3.96	3.56	3.27	3.14	4.63	4.16	4.03	3.57	4.24	4.64
9	4.52	4.24	3.99	3.53	3.26	3.17	4.74	4.17	4.02	3.59	4.31	4.63
10	4.53	4.18	4.03	3.50	3.25	3.17	4.81	4.18	3.99	3.63	4.32	4.59
11	4.51	4.15	4.03	3.47	3.24	3.17	4.85	4.15	3.97	3.67	4.34	4.54
12	4.50	4.12	4.03	3.46	3.23	3.18	4.85	4.16	3.96	3.67	4.37	4.54
13	4.49	4.06	4.05	3.45	3.23	3.25	4.85	4.24	3.92	3.68	4.41	4.55
14	4.50	4.01	4.04	3.44	3.22	3.25	4.82	4.16	3.92	3.70	4.54	4.52
15	4.48	3.96	4.02	3.42	3.24	3.25	4.82	4.19	3.91	3.72	4.47	4.49
16	4.47	3.93	4.05	3.40	3.23	3.24	4.77	4.19	3.86	3.78	4.58	4.46
17	4.53	3.99	4.03	3.39	3.23	3.23	4.74	4.17	3.84	3.80	4.71	4.47
18	4.58	4.05	4.02	3.38	3.22	3.24	4.71	4.16	3.83	3.85	4.74	4.45
19	4.58	4.10	4.03	3.36	3.21	3.23	4.64	4.16	3.80	3.88	4.77	4.45
20	4.54	4.07	4.04	3.39	3.21	3.23	4.60	4.16	3.78	3.90	4.80	4.57
21	4.50	4.02	4.05	3.41	3.22	3.22	4.54	4.17	3.76	3.93	4.81	4.55
22	4.47	4.01	4.04	3.40	3.20	3.21	4.49	4.17	3.79	3.95	4.82	4.55
23	4.47	4.01	4.02	3.39	3.20	3.21	4.44	4.15	3.77	3.97	4.81	4.59
24	4.49	4.03	4.00	3.38	3.19	3.20	4.43	4.13	3.75	3.99	4.87	4.56
25	4.48	4.00	3.99	3.37	3.18	3.22	4.37	4.10	3.78	4.01	4.90	4.56
26	4.47	3.99	3.97	3.36	3.17	3.28	4.32	4.10	3.73	4.01	4.85	4.53
27	4.48	3.98	3.93	3.35	3.17	3.30	4.28	4.13	3.72	4.02	4.84	4.56
28	4.46	3.95	3.90	3.34	3.17	3.30	4.26	4.15	3.70	4.04	4.85	4.52
29	4.43	3.96	3.86	3.32	3.17	3.39	4.21	4.15	3.68	4.07	4.82	4.51
30	4.43	4.00	3.82	3.32	---	3.43	4.17	4.15	3.65	4.09	4.79	4.52
31	4.39	---	3.79	3.36	---	3.47	---	4.15	---	4.08	4.77	---
MEAN	4.49	4.12	3.99	3.47	3.23	3.23	4.42	4.16	3.89	3.80	4.54	4.58
MAX	4.58	4.39	4.05	3.77	3.32	3.47	4.85	4.24	4.14	4.09	4.90	4.76
MIN	4.39	3.93	3.79	3.32	3.17	3.13	3.52	4.10	3.65	3.57	4.10	4.45

WTR YR 1988 MEAN 3.99 MAX 4.90 MIN 3.13

04057510 STURGEON RIVER NEAR NAHMA JUNCTION, MI

LOCATION.--Lat 45°56'35", long 86°42'20", in SW1/4 SE1/4 sec.17, T.41 N., R.19 W., Delta County, Hydrologic Unit 04030112, Hiawatha National Forest, on left bank 30 ft upstream from bridge on Forest Service Road 2231, 500 ft downstream from Mormon Creek, 0.1 mi east of Federal Forest Highway 13, and 3.2 mi north of Nahma Junction.

DRAINAGE AREA.--183 mi^2.

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Datum of gage is 610.99 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 4-8, Dec. 17 to Apr. 1, and Apr. 3, 4. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 202 ft^3/s, 14.99 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,120 ft^3/s, Apr. 21, 1985, gage height, 11.50 ft; minimum, 32 ft^3/s, July 8, 1988, gage height, 3.55 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,200 ft^3/s, Apr. 7, gage height, 8.57 ft; minimum, 32 ft^3/s, July 8, gage height, 3.55 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	89	131	327	100	84	77	560	152	68	38	36	75
2	122	126	285	96	83	76	612	143	66	37	35	71
3	172	126	250	93	82	76	780	134	62	37	34	90
4	161	143	230	91	81	76	820	127	60	36	36	184
5	144	150	210	88	80	75	895	121	59	35	46	160
6	133	143	190	85	79	75	1090	115	58	34	60	133
7	133	135	180	82	78	76	1160	110	55	33	63	113
8	135	131	175	81	78	80	1030	106	55	33	61	98
9	129	125	240	80	77	90	888	104	56	42	71	88
10	122	121	336	80	77	100	758	103	53	56	60	79
11	116	117	321	80	76	104	660	99	52	78	53	73
12	111	113	309	79	76	104	580	96	50	65	52	71
13	107	111	281	79	75	103	514	99	49	55	53	134
14	104	109	249	80	75	102	460	97	48	50	57	116
15	101	107	221	80	74	100	408	95	46	50	51	98
16	100	107	206	82	75	99	372	92	45	64	50	88
17	119	218	200	88	76	98	345	89	46	61	93	82
18	155	321	195	92	77	97	326	85	45	58	94	78
19	145	292	190	92	79	95	300	83	44	53	78	83
20	132	263	185	92	81	94	283	81	44	51	70	196
21	124	217	180	91	81	93	259	80	42	48	64	205
22	119	229	175	91	81	91	240	78	50	46	59	181
23	132	215	170	90	80	92	227	75	50	44	71	171
24	136	226	160	90	79	96	223	73	46	43	103	143
25	131	219	155	89	78	115	211	70	47	42	110	122
26	126	197	145	88	78	175	199	73	46	40	115	112
27	161	180	135	88	77	190	191	80	44	42	108	126
28	175	168	130	87	77	185	190	79	43	39	109	126
29	160	208	125	87	77	300	176	76	41	37	99	116
30	149	306	120	86	---	430	163	73	40	36	90	110
31	139	---	115	85	---	500	---	70	---	35	82	---
TOTAL	4082	5254	6390	2692	2271	4064	14920	2958	1510	1418	2163	3522
MEAN	132	175	206	86.8	78.3	131	497	95.4	50.3	45.7	69.8	117
MAX	175	321	336	100	84	500	1160	152	68	78	115	205
MIN	89	107	115	79	74	75	163	70	40	33	34	71
CFSM	.72	.96	1.13	.47	.43	.72	2.72	.52	.28	.25	.38	.64
IN.	.83	1.07	1.30	.55	.46	.83	3.03	.60	.31	.29	.44	.72

CAL YR 1987 TOTAL 48252 MEAN 132 MAX 387 MIN 59 CFSM .72 IN 9.81
WTR YR 1988 TOTAL 51244 MEAN 140 MAX 1160 MIN 33 CFSM .77 IN 10.42

04057800 MIDDLE BRANCH ESCANABA RIVER AT HUMBOLDT, MI

LOCATION.--Lat 46°29'57", long 87°53'11", in SW1/4 sec.1, T.47 N., R.29 W., Marquette County, Hydrologic Unit 04030110, on left bank 15 ft upstream from county highway, 1.5 mi downstream from Halfway Creek, and 0.3 mi north of Humboldt.

DRAINAGE AREA.--46.0 mi^2.

PERIOD OF RECORD.--June 1959 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. V-notch sharp-crested weir since Oct. 3, 1960. Datum of gage is 1,521.20 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Sept. 1, 1960, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 4-10, 13-18, and Jan. 20 to Feb. 11. Records good except for estimated daily discharges, which are fair. From July 1960 to June 1972, some diversion 100 ft upstream by industry for iron ore processing; figures of runoff adjusted. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 61.4 ft^3/s, 18.13 in/yr, adjusted for diversion 1960 to 1972.

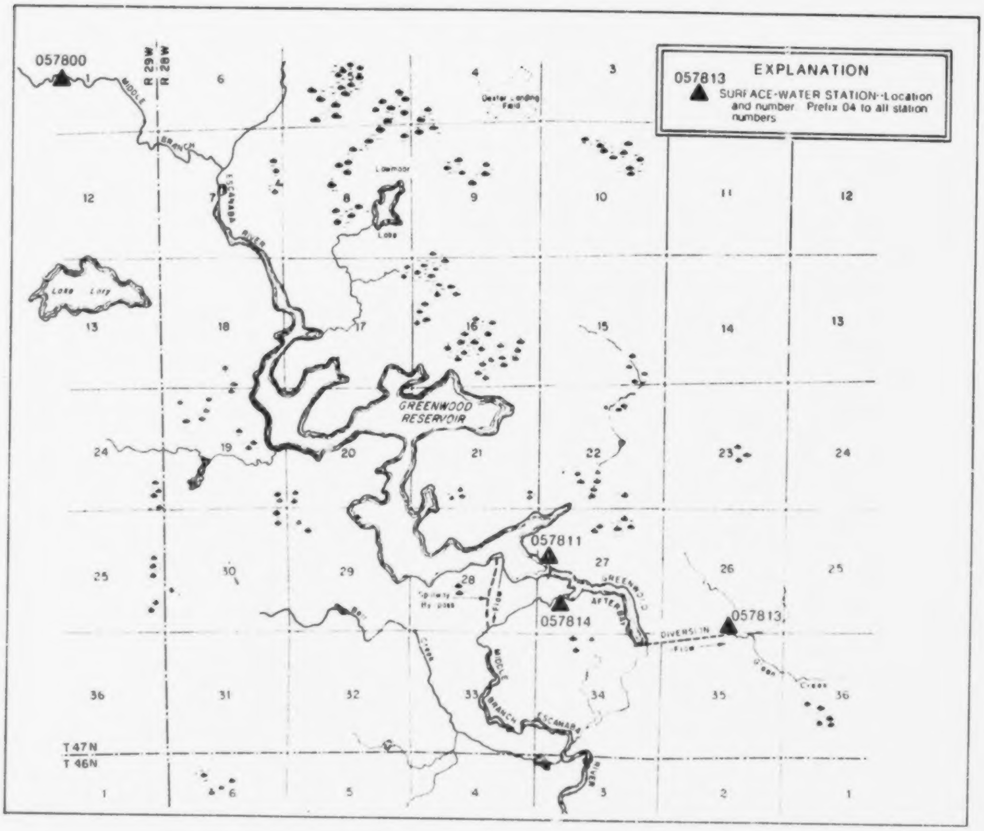
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,930 ft^3/s, Apr. 20, 1985, gage height, 9.21 ft; minimum, 4.0 ft^3/s, Sept. 12, 1976; minimum gage height, 1.07 ft, Aug. 24, 1960.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 698 ft^3/s, Apr. 7, gage height, 6.16 ft; minimum, 4.9 ft^3/s, July 29, gage height, 1.54 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	17	51	89	42	32	23	86	65	23	8.6	6.9	24
2	35	46	82	41	31	23	104	59	21	7.9	13	22
3	85	45	78	41	31	23	130	55	20	7.3	75	21
4	80	50	57	40	31	22	199	50	18	7.3	75	30
5	66	51	50	40	30	21	289	46	18	6.9	112	36
6	67	46	45	38	30	21	449	44	17	6.6	93	33
7	87	44	13	38	30	22	656	40	16	6.9	54	28
8	91	41	41	37	29	25	648	43	16	6.6	35	24
9	77	39	72	36	29	35	539	48	16	9.0	27	23
10	67	34	149	35	29	34	478	48	15	8.8	22	20
11	55	32	167	34	28	34	429	44	14	8.4	19	17
12	47	31	110	35	28	35	349	42	13	7.9	17	17
13	41	32	90	35	28	37	301	52	12	7.6	20	18
14	37	31	77	34	27	37	271	46	12	7.1	48	17
15	36	30	69	33	28	36	237	43	11	10	36	14
16	68	34	104	33	28	34	201	41	12	13	31	15
17	91	96	125	33	29	32	184	37	12	11	107	27
18	80	192	89	33	28	32	177	35	12	8.8	167	28
19	65	183	77	32	28	30	156	33	12	8.0	134	27
20	53	128	67	35	28	30	133	30	11	7.5	78	44
21	52	110	63	39	29	30	114	30	10	7.3	53	42
22	57	84	57	40	28	26	100	31	9.9	6.5	40	36
23	64	68	52	39	26	27	93	34	9.8	6.1	43	34
24	74	63	49	38	25	27	94	31	10	6.2	48	30
25	76	56	49	38	24	49	89	28	11	7.6	45	25
26	70	50	46	37	23	67	89	29	9.9	6.3	48	36
27	79	46	45	37	23	74	86	33	9.2	5.8	42	69
28	83	45	44	36	22	81	81	36	9.6	5.7	38	57
29	75	58	42	35	22	78	75	32	9.3	5.3	33	47
30	66	86	41	33	---	96	68	29	9.0	6.3	29	43
31	57	---	41	33	---	86	---	26	---	6.5	26	---
TOTAL	1998	1902	2210	1130	804	1229	6905	1240	398.7	234.8	1614.9	904
MEAN	64.5	63.4	71.3	36.5	27.7	39.6	230	40.0	13.3	7.57	52.1	30.1
MAX	91	192	167	42	32	96	656	65	23	13	167	69
MIN	17	30	41	32	22	21	68	26	9.0	5.3	6.9	14
CFSM	1.40	1.38	1.55	.79	.60	.86	5.00	.87	.29	.17	1.13	.65
IN.	1.62	1.54	1.79	.91	.65	.99	5.58	1.00	.32	.19	1.31	.73

CAL YR 1987 TOTAL 15334.8 MEAN 42.0 MAX 192 MIN 7.9 CFSM .91 IN 12.40
WTR YR 1988 TOTAL 20570.4 MEAN 56.2 MAX 656 MIN 5.3 CFSM 1.22 IN 16.63


057800
R 29W
R 28W
MIDDLE
BRANCH
ESCANABA
RIVER
Dexter Landing Field
Lowmoor
Lost
Lost Lory
GREENWOOD RESERVOIR
057811
057814
057813
Spillway By pass
Flow
GREENWOOD
AFTERBAY
DIVERSION
Flow
Green Creek
Bell Creek
MIDDLE BRANCH ESCANABA RIVER
T 47N
T 46N
EXPLANATION
057813
SURFACE-WATER STATION--Location and number. Prefix 04 to all station numbers
6
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1

Figure 8.--Identification number and location of active surface-water gaging stations in and around the Greenwood Reservoir Complex.

04057811 GREENWOOD RESERVOIR NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'32", long 87°48'02", in NW1/4 SW1/4 sec.27, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, at downstream side of dam on Middle Branch Escanaba River, 3.7 mi southwest of Greenwood.

DRAINAGE AREA.--67.4 mi².

PERIOD OF RECORD.--December 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,400.00 ft above National Geodetic Vertical Datum of 1929 (levels by Cleveland-Cliffs Iron Co.); gage readings have been converted to elevations NGVD. Prior to Feb. 20, 1973, nonrecording gage at same site and datum.

REMARKS.--The reservoir is formed by an earth/rockfill main dam and several earthfill dikes surrounding the storage area. Storage began Dec. 22, 1972. The fixed-crest concrete spillway was completed in September 1973. Capacity of reservoir, 23,300 acre-ft at spillway elevation 1,515 ft. Above elevation 1,515 ft, water flows over concrete spillway into Middle Branch Escanaba River about 2,000 ft downstream from Greenwood Release (station 04057814). The main dam is equipped with an outlet structure with 4 valves to control flow to afterbay (conservation pool) which has a capacity of 420 acre-ft at elevation 1,480 ft. Two outlet systems from the afterbay provide for diversion and release flow. Diverted flow to Green Creek gaged at Greenwood Diversion (station 04057813); released flow to Middle Branch Escanaba River gaged at Greenwood Release (station 04057814). Reservoir impounds water for diversion to Schweitzer Reservoir (station 04058190), for use in iron ore processing.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 26,520 acre-ft, Apr. 21, 22, 23, 1985, elevation, 1,517.3 ft; minimum since first filling, 3,240 acre-ft, Mar. 12, 1977, elevation, 1,491.1 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 25,120 acre-ft, Apr. 8-10, elevation, 1,516.3 ft; minimum, 17,340 acre-ft, Oct. 1, 2, elevation, 1,510.2 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	1,510.2	17,340	--	--
Oct. 31	1,511.8	19,260	+1,920	+31.2
Nov. 30	1,514.0	22,000	+2,740	+46.0
Dec. 31	1,515.1	23,440	+1,440	+23.4
CAL YR 1987	--	--	+5,900	+8.1
Jan. 31	1,514.7	22,910	-530	-8.6
Feb. 29	1,514.2	22,260	-650	-11.3
Mar. 31	1,514.0	22,000	-260	-4.2
May 31	1,514.8	23,040	-680	-11.1
June 30	1,512.9	20,580	-2,460	-41.3
July 31	1,510.4	17,580	-3,000	-48.8
Aug. 31	1,512.2	19,740	+2,160	+35.1
Sept. 30	1,512.3	19,860	+120	+2.0
WTR YR 1988	--	--	+2,520	+3.5

04057813 GREENWOOD DIVERSION NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'04", long 87°46'10", in NW1/4 NE1/4 sec.35, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, on left bank at downstream end of pipeline, 200 ft upstream from Green Creek, 0.7 mi downstream from Greenwood Afterbay, and 3.6 mi south of Greenwood.

PERIOD OF RECORD.--December 1972 to current year.

GAGE.--Water-stage recorder and concrete flume. Datum of gage is 1,454.57 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Aug. 22, 1973, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records excellent. Flow completely regulated. A pipeline, 0.7 mi long, diverts water from Greenwood Reservoir (station 04057811) into Green Creek, tributary to Schweitzer Reservoir (station 04058190). Water is used for iron ore processing; some returned to Middle Branch Escanaba River 27 mi downstream via another Green Creek; some returned 31 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 30 ft³/s, June 25-28, 1977, Nov. 9, 1979; no flow, Dec. 27, 1972 to Jan. 6, 1973; minimum daily discharge since diversion began, 0.01 ft³/s, Apr. 16, 17, 1987.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16	25	3.5	20	21	11	.04	5.8	24	26	26	4.6
2	23	25	3.5	20	21	11	.04	5.8	24	26	26	10
3	24	25	3.5	19	17	12	.04	5.7	24	27	26	9.8
4	24	25	3.5	20	14	14	.04	5.7	24	27	25	9.6
5	23	25	3.5	21	14	14	.04	5.6	23	27	25	9.3
6	24	25	3.5	22	14	13	.04	5.5	24	27	25	9.2
7	24	24	3.5	23	14	13	.04	5.5	26	27	25	9.0
8	24	21	3.4	23	14	12	.04	5.5	26	26	25	8.8
9	25	16	3.5	23	14	9.9	.04	5.4	26	26	25	8.5
10	25	7.0	3.5	23	14	10	.04	5.4	26	26	24	8.9
11	25	11	3.5	24	14	10	.04	5.3	26	26	24	9.3
12	25	17	3.5	23	14	10	.04	5.3	26	26	24	10
13	25	25	3.5	23	14	10	.04	5.4	26	26	24	11
14	25	26	3.5	23	14	10	.04	5.3	26	26	24	11
15	25	26	3.5	23	14	10	.04	5.3	27	26	21	12
16	25	26	3.5	23	14	11	.04	5.3	26	26	11	18
17	25	19	3.5	23	14	11	.04	8.3	26	26	4.5	25
18	25	12	3.5	24	14	11	.04	13	26	26	.40	26
19	25	5.8	3.5	26	14	11	.04	16	26	26	.42	26
20	25	.04	3.5	26	14	11	.04	21	26	26	.42	26
21	25	.04	3.5	26	14	11	.04	23	26	26	.41	21
22	25	.04	3.5	26	14	11	.04	23	26	26	.41	14
23	25	.04	3.5	26	14	14	.04	24	26	26	.44	14
24	25	.04	3.5	26	14	16	.04	23	26	26	.46	14
25	25	1.7	3.5	23	12	12	2.7	23	26	26	.46	14
26	25	3.6	3.5	20	10	8.5	6.0	23	26	26	.46	14
27	25	3.6	3.5	20	10	8.6	5.9	23	26	26	.42	14
28	25	3.5	10	21	10	3.1	5.9	23	26	26	.40	14
29	25	3.5	21	21	10	.04	5.8	23	26	25	.40	14
30	25	3.5	20	21	---	.04	5.8	23	26	25	.40	14
31	25	---	20	21	---	.04	---	24	---	25	.40	---
TOTAL	757	405.40	165.4	703	405	309.22	33.06	401.1	768	808	390.40	409.0
MEAN	24.4	13.5	5.34	22.7	14.0	9.97	1.10	12.9	25.6	26.1	12.6	13.6
MAX	25	26	21	26	21	16	6.0	24	27	27	26	26
MIN	16	.04	3.4	19	10	.04	.04	5.3	23	25	.40	4.6

CAL YR 1987 TOTAL 6110.40 MEAN 16.7 MAX 26 MIN .01
WTR YR 1988 TOTAL 5554.58 MEAN 15.2 MAX 27 MIN .04

04057814 GREENWOOD RELEASE NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'22", long 87°47'52", in NW1/4 SW1/4 sec.27, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, on left bank at outlet of Greenwood Afterbay releasing to Middle Branch Escanaba River, 2.6 mi upstream from Bell Creek and 3.8 mi southwest of Greenwood.

DRAINAGE AREA.--67.4 mi^2.

PERIOD OF RECORD.--October 1972 to current year.

GAGE.--Water-stage recorder and concrete flume. Datum of gage is 1,473.77 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Nov. 7, 1973, nonrecording gage at same site and different datum.

REMARKS.--Estimated daily discharges: Mar. 16-23, 25-28. Records excellent except for estimated daily discharges, which are fair. Since December 1972, flow from Greenwood Reservoir (station 04057811) below spillway elevation 1,515 ft is completely regulated by the afterbay release structure into the Middle Branch Escanaba River. Since January 1973, water diverted immediately upstream from station via Greenwood Diversion (station 04057813) to Green Creek for iron ore processing and some returned to Middle Branch Escanaba River 27 mi downstream via another Green Creek. Since October 1979, some of the diversion returned 31 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Overflow from reservoir spillway bypasses and returns to the Middle Branch Escanaba River 0.5 mi downstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge (prior to regulation), 290 ft^3/s, Oct. 1, 1972; (since regulation began), 63 ft^3/s, July 10, 11, 1974; minimum daily, 6.4 ft^3/s, Nov. 10, 1987, release structure closed for trash rack cleaning and flume inspection.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	21	24	25	22	27	26	58	22	28	25	25	25
2	22	24	25	22	27	26	58	23	27	25	25	23
3	21	24	25	22	27	26	59	24	27	25	25	22
4	19	24	25	22	27	32	59	23	27	25	25	22
5	17	24	25	24	26	39	59	23	27	25	25	21
6	19	24	25	25	26	38	59	23	27	25	24	21
7	21	23	25	26	26	37	58	23	26	25	23	20
8	21	20	24	26	26	37	56	23	26	25	23	25
9	24	6.8	25	26	26	38	55	22	26	25	23	25
10	25	6.4	25	27	26	38	53	22	26	25	24	24
11	26	25	25	27	26	39	52	22	26	25	25	24
12	26	26	25	26	26	39	51	22	25	25	25	25
13	26	27	25	26	26	39	51	22	25	25	25	26
14	26	26	25	26	26	40	50	22	25	25	26	26
15	26	26	25	26	26	46	50	22	25	25	26	26
16	25	25	25	26	26	58	50	22	25	25	26	26
17	25	24	24	26	26	58	50	22	25	25	27	25
18	25	24	24	26	26	58	37	21	25	25	26	25
19	25	24	24	25	26	58	29	23	24	25	26	25
20	25	24	24	25	26	58	25	26	25	25	26	25
21	25	24	24	25	26	58	23	27	24	25	26	25
22	25	24	23	25	26	58	23	28	24	24	26	25
23	25	25	24	25	26	58	23	29	24	24	26	25
24	25	25	24	25	26	56	23	29	24	24	26	25
25	24	25	24	25	26	57	23	29	25	24	26	25
26	24	25	23	25	26	58	23	29	25	24	26	25
27	24	25	23	26	26	58	23	29	24	24	26	25
28	24	25	24	26	26	58	22	29	25	24	26	25
29	24	25	24	26	26	58	22	29	25	24	24	25
30	24	25	22	27	---	58	22	29	25	24	23	25
31	24	---	22	27	---	58	---	29	---	24	24	---
TOTAL	733	699.2	752	783	758	1465	1246	768	762	765	779	731
MEAN	23.6	23.3	24.3	25.3	26.1	47.3	41.5	24.8	25.4	24.7	25.1	24.4
MAX	26	27	25	27	27	58	59	29	28	25	27	26
MIN	17	6.4	22	22	26	26	22	21	24	24	23	20

CAL YR 1997 TOTAL 8921.2 MEAN 24.4 MAX 27 MIN 6.4
WTR YR 1988 TOTAL 10241.2 MEAN 28.0 MAX 59 MIN 6.4

04058190 SCHWEITZER RESERVOIR NEAR PALMER, MI

LOCATION.--Lat 46°25'00", long 87°38'48", in SE1/4 NW1/4 sec.2, T.46 N., R.27 W., Marquette County, Hydrologic Unit 04030110, on left bank 120 ft upstream from dam on Schweitzer Creek, 3.0 mi southwest of Palmer.

DRAINAGE AREA.--23.1 mi².

PERIOD OF RECORD.--January 1963 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,300.00 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. reference mark); gage readings have been converted to elevations NGVD. Prior to Oct. 25, 1967, nonrecording gage at same site and datum.

REMARKS.--Reservoir is formed by an earthfill dam with fixed crest concrete spillway completed in 1963. Capacity of reservoir, 5,300 acre-ft at spillway elevation, 1,338.00 ft. The dam includes a discharge pipe equipped with valve to control release flow to Schweitzer Creek (station 04058200). An average of 1.7 ft³/s was diverted from the headwaters of basin by the City of Ishpeming for municipal supply and the effluent discharged to the Carp River basin. An average of 26 ft³/s was diverted from reservoir for iron ore processing, some returned to Middle Branch Escanaba River basin via Green Creek and some returned to the East Branch Escanaba River basin via Goose Lake Outlet. Since January 1973, controlled diversion from Greenwood Reservoir (station 04057811) via Greenwood Diversion (station 04057813) into Schweitzer Reservoir. Controlled inflow averaged 15.2 ft³/s for the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents recorded, 5,900 acre-ft, May 31, 1970, Apr. 20, 1985, elevation, 1,339.5 ft; minimum recorded since first filling, 2,920 acre-ft, Apr. 10, 1974, elevation, 1,329.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 5,620 acre-ft, Apr. 6, 7, elevation, 1,338.8 ft; minimum, 4,170 acre-ft, Oct. 1, 2, elevation, 1,334.4 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	1,334.5	4,200	--	--
Oct. 31	1,336.7	4,860	+660	+10.7
Nov. 30	1,337.4	5,090	+230	+3.9
Dec. 31	1,337.1	4,980	-110	-1.8
CAL YR 1987	--	--	+510	+0.7
Jan. 31	1,337.9	5,260	+280	+4.6
Feb. 29	1,336.2	4,710	-550	-9.6
Mar. 31	1,336.4	4,770	+60	+1.0
Apr. 30	1,337.7	5,200	+430	+7.2
May 31	1,336.2	4,710	-490	-8.0
June 30	1,334.8	4,290	-420	-7.1
July 31	1,334.6	4,230	-60	-1.0
Aug. 31	1,337.0	4,950	+720	+11.7
Sept. 30	1,337.6	5,160	+210	+3.5
WTR YR 1988	--	--	+960	+1.3

04058200 SCHWEITZER CREEK NEAR PALMER, MI

LOCATION.--Lat 46°24'40", long 87°37'27", in SW1/4 sec.1, T.46 N., R.27 W., Marquette County, Hydrologic Unit 04030110, on right bank 10 ft upstream from highway bridge, 2.5 mi southwest of Palmer.

DRAINAGE AREA.--23.6 mi².

PERIOD OF RECORD.--October 1960 to current year.

GAGE.--Water-stage recorder. Concrete control since Oct. 1, 1963. Elevation of gage is 1,270 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Aug. 21, 1961, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 3-10, Feb. 2, 3, 5-13, 21, 22, 24, 25, and Mar. 4. Records good. Since August 1962, flow completely regulated by Schweitzer Reservoir (station 04058190) 1.0 mi upstream. An average of 1.7 ft³/s was diverted from headwaters of basin by the City of Ishpeming for municipal supply and the effluent discharged to the Carp River basin. An average of 26 ft³/s was diverted from Schweitzer Reservoir by industry for iron ore processing, some returned to the Middle Branch Escanaba River via Green Creek and some returned via Goose Lake Outlet and East Branch Escanaba River. Diversion into Schweitzer Reservoir from Greenwood Reservoir (station 04057811) via Greenwood Diversion (station 04057813). Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 860 ft³/s, May 31, 1970, gage height, 6.50 ft; minimum, 0.4 ft³/s, Sept. 6, 1962, gage height, 1.22 ft; minimum daily, 1.0 ft³/s, Apr. 9-18, May 5, 6, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 275 ft³/s, Apr. 7, gage height, 4.78 ft; minimum daily, 3.7 ft³/s, July 28-31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.2	4.5	5.0	4.8	4.5	4.3	6.1	5.2	4.6	4.1	3.8	4.2
2	5.1	4.4	4.8	4.8	4.4	4.3	6.5	5.1	4.5	4.2	4.1	4.2
3	4.5	4.6	4.8	4.8	4.4	4.3	7.6	5.1	4.6	4.1	4.6	4.8
4	4.3	4.5	4.8	4.8	4.3	4.3	7.7	5.0	4.5	4.1	5.1	4.8
5	4.4	4.5	4.8	4.8	4.3	4.3	69	5.0	4.6	4.1	4.9	4.4
6	4.4	4.5	4.6	4.7	4.3	4.4	223	5.0	4.6	4.1	4.1	4.2
7	4.8	4.5	4.7	4.6	4.3	4.4	241	5.0	4.5	4.1	4.1	4.2
8	4.4	4.5	4.8	4.6	4.3	4.9	167	5.1	4.8	4.3	4.0	4.2
9	4.4	4.5	6.5	4.5	4.3	4.7	118	5.3	4.5	4.3	4.0	4.1
10	4.3	4.5	5.5	4.5	4.3	4.7	88	5.2	4.5	4.2	3.8	4.0
11	4.3	4.5	5.2	4.5	4.3	4.7	68	5.0	4.5	4.2	4.0	4.1
12	4.3	4.5	5.0	4.5	4.3	4.6	55	5.1	4.5	4.2	4.2	4.3
13	4.3	4.5	5.0	4.5	4.3	4.5	46	5.3	4.5	4.1	5.3	4.2
14	4.3	4.5	4.9	4.4	4.3	4.5	38	5.0	4.4	3.9	4.7	4.0
15	4.6	4.5	5.0	4.5	4.3	4.5	30	5.0	4.3	4.5	4.3	4.0
16	4.6	4.7	5.0	4.5	4.3	4.5	23	5.0	4.4	4.2	4.7	4.2
17	4.4	6.5	4.8	4.5	4.3	4.5	21	5.0	4.3	4.0	6.8	4.4
18	4.3	5.2	4.9	4.5	4.4	4.5	20	4.9	4.3	4.0	23	4.1
19	4.3	5.0	4.8	4.5	4.4	4.5	13	4.8	4.3	3.9	21	4.6
20	4.4	5.2	5.0	4.8	4.4	4.5	10	4.8	4.4	3.8	9.2	4.6
21	4.9	4.9	4.8	4.6	4.4	4.5	7.2	4.9	4.3	3.8	4.9	4.3
22	4.6	4.8	4.8	4.5	4.4	4.4	5.9	4.9	4.4	3.8	4.5	4.3
23	4.6	4.9	4.8	4.5	4.3	4.4	5.7	4.9	4.3	3.8	4.6	4.3
24	4.6	4.8	4.8	4.5	4.3	4.6	5.4	4.8	4.4	3.9	4.4	4.2
25	4.5	4.8	4.8	4.5	4.3	6.7	5.4	4.8	4.2	3.8	4.4	4.2
26	4.6	4.8	4.8	4.5	4.3	6.0	5.4	4.9	4.1	3.8	4.3	5.0
27	4.5	4.6	4.8	4.5	4.3	5.2	5.3	4.9	4.1	3.8	4.3	4.6
28	4.4	4.8	4.8	4.5	4.3	5.1	5.2	4.8	4.2	3.7	4.3	4.3
29	4.5	5.4	4.8	4.5	4.3	6.4	5.2	4.8	4.1	3.7	4.4	4.5
30	4.4	5.2	4.8	4.5	---	6.2	5.2	4.7	4.1	3.7	4.3	4.4
31	4.4	---	4.8	4.5	---	5.9	---	4.7	---	3.7	4.1	---
TOTAL	138.6	143.1	152.7	141.7	125.6	149.3	1313.8	154.0	131.8	123.9	178.2	129.7
MEAN	4.47	4.77	4.93	4.57	4.33	4.82	43.8	4.97	4.39	4.00	5.75	4.32
MAX	5.1	6.5	6.5	4.8	4.5	6.7	241	5.3	4.8	4.5	23	5.0
MIN	4.2	4.4	4.6	4.4	4.3	4.3	5.2	4.7	4.1	3.7	3.8	4.0

CAL YR 1987 TOTAL 1694.0 MEAN 4.64 MAX 6.5 MIN 4.1
WTR YR 1988 TOTAL 2882.4 MEAN 7.88 MAX 241 MIN 3.7

04058940 ESCANABA RIVER NEAR ST. NICHOLAS, MI

LOCATION.--Lat 45°58'45", long 87°16'13", in SW1/4 NE1/4 sec.2, T.41 N., R.24 W., Delta County, Hydrologic Unit 04030110, on right bank 600 ft downstream from Boney Falls Dam, 2.1 miles west of St. Nicholas and 23.1 miles upstream from mouth.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--December 1987 to September 1988 (gage heights only).

GAGE.--Water-stage recorder. Elevation of gage is 875.0 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Diurnal fluctuation caused by hydroelectric plant 600 ft upstream. Some regulation by Schweitzer Reservoir (station 04058190) about 40 mi upstream and Greenwood Reservoir (station 04057811) about 50 mi upstream. Because storage capacity is small, daily flows are not affected appreciably. Gage-height telemeter at station.

EXTREMES FOR CURRENT YEAR.--Maximum gage height recorded, 5.11 ft, Apr. 7, but may have been higher during period of no gage height record, Apr. 8-14; minimum daily, 2.03 ft, July 4, 1988.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1			---	2.27	2.26	2.15	3.45	2.75	2.44	2.17	2.13	2.48
2			---	2.16	2.27	2.08	3.66	2.72	---	2.09	2.17	2.49
3			---	2.16	2.26	2.12	3.92	2.65	---	2.04	2.21	2.54
4			---	2.27	2.26	2.16	4.28	2.59	---	2.03	2.32	2.87
5			---	2.29	2.26	2.16	4.59	2.60	---	2.05	2.64	3.13
6			---	2.24	2.26	2.16	4.78	2.57	---	---	2.89	3.07
7			---	2.21	2.25	2.16	5.10	2.55	2.33	---	2.78	2.95
8			---	2.20	2.25	2.17	---	2.56	2.28	---	2.60	2.80
9			---	2.18	2.25	2.26	---	2.58	2.22	2.32	2.47	2.70
10			---	2.17	2.24	2.32	---	2.57	2.14	2.18	2.43	2.62
11			---	2.17	2.24	2.33	---	2.55	2.15	2.28	2.33	2.57
12			---	2.19	2.24	2.33	---	2.53	2.15	2.27	2.32	2.55
13			---	2.22	2.25	2.31	---	2.58	2.14	2.25	2.38	2.53
14			2.90	2.23	2.24	2.31	---	2.63	2.22	2.23	2.68	2.52
15			2.85	2.23	2.25	2.31	4.03	2.62	2.22	2.28	3.07	2.47
16			2.59	2.20	2.22	2.31	3.85	2.59	2.33	2.34	3.07	2.47
17			2.71	2.22	2.22	2.31	3.72	2.55	2.53	2.35	3.24	2.52
18			2.68	2.27	2.24	2.33	3.60	2.50	2.53	2.41	3.76	2.65
19			2.55	2.35	2.22	2.29	3.48	2.47	2.43	2.32	3.73	2.71
20			2.63	2.31	2.21	2.30	3.35	2.43	2.35	2.29	3.53	2.82
21			2.67	2.25	2.24	2.29	3.20	2.43	2.27	2.31	3.21	2.98
22			2.68	2.23	2.25	2.32	3.12	2.44	2.22	2.27	2.80	2.98
23			2.72	2.27	2.28	2.35	3.09	2.43	2.13	2.22	2.83	3.00
24			2.68	2.26	2.25	2.35	3.04	2.41	2.16	2.15	2.74	2.82
25			2.58	2.24	2.25	2.43	2.99	2.40	2.13	2.15	2.67	2.73
26			2.36	2.24	2.26	2.61	2.97	2.41	2.11	2.19	2.68	2.69
27			2.45	2.24	2.25	2.73	2.83	2.43	2.21	2.22	2.68	2.81
28			2.43	2.27	2.24	2.83	2.84	2.46	2.21	2.27	2.65	2.85
29			2.48	2.26	2.23	3.02	2.85	2.47	2.20	2.24	2.62	2.81
30			2.35	2.26	---	3.19	2.78	2.43	2.19	2.22	2.57	2.75
31			2.30	2.27	---	3.33	---	2.43	---	2.12	2.54	---
MEAN			---	2.24	2.25	2.40	---	2.53	---	---	2.73	2.73
MAX			---	2.35	2.28	3.33	---	2.75	---	---	3.76	3.13
MIN			---	2.16	2.21	2.08	---	2.40	---	---	2.13	2.47

04059000 ESCANABA RIVER AT CORNELL, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°54'31", long 87°12'49", in NW1/4 sec.32, T.41 N., R.23 W., Delta County, Hydrologic Unit 04030110, on right bank 50 ft downstream from bridge on County Road 519, 0.4 mi downstream from Bobs Creek, 0.7 mi northeast of Cornell, and 16 mi upstream from mouth.

DRAINAGE AREA.--870 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1903 to December 1912, January 1913 to November 1915 (gage heights only), October 1950 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "near Escanaba" 1903-15.

REVISED RECORDS.--WSP 1387: 1904. WDR MI-85: 1970 (M).

GAGE.--Water-stage recorder. Datum of gage is 749.26 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). August 1903 to November 1915, nonrecording gage at site 10 mi downstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 18 to Apr. 5. Water-discharge records good except for estimated daily discharges, which are fair. Since 1950, diurnal fluctuation and occasional slight regulation by Boney Falls powerplant 7 mi upstream. Since August 1962, some regulation by Schweitzer Reservoir (station 04058190) about 50 mi upstream. Since December 1972, some regulation by Greenwood Reservoir (station 04057811) about 60 mi upstream. Gage-height telemeter at station.

AVERAGE DISCHARGE.--47 years (water years 1904-12, 1951-88), 883 ft^3/s, 13.78 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,700 ft^3/s, Apr. 26, 1979, gage height, 5.00 ft; maximum gage height, 6.40 ft, Apr. 9, 1971, backwater from ice; minimum discharge observed, 90 ft^3/s, July 5, 1910, gage height, 1.5 ft, site and datum then in use, but may have been less during extended periods of no gage-height record during winter periods of 1903-12, or periods of ice effect in 1959.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,470 ft^3/s, Apr. 8, gage height, 4.10 ft; maximum gage height, 5.26 ft, Apr. 1, backwater from ice; minimum daily discharge, 153 ft^3/s, July 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	303	532	1090	370	380	250	1650	850	363	214	157	381
2	359	496	948	310	380	230	2000	804	315	185	173	368
3	447	486	738	350	380	300	2500	741	292	153	209	420
4	483	542	664	400	380	300	3300	665	280	155	263	683
5	551	630	794	400	360	260	4400	663	281	166	463	999
6	510	632	741	350	350	305	5260	634	272	159	730	950
7	524	585	705	330	345	305	6160	600	258	159	639	812
8	689	524	651	330	335	325	6220	607	252	178	497	657
9	716	498	746	320	325	450	5680	614	240	257	378	559
10	581	474	1100	310	315	460	5040	601	192	208	345	479
11	521	428	1380	305	305	460	4340	604	189	251	289	428
12	483	375	1200	350	300	450	3750	588	194	228	283	416
13	485	421	1070	350	300	450	3300	611	185	244	312	410
14	474	445	1050	350	300	445	2860	659	210	232	498	412
15	455	425	985	350	300	440	2520	643	254	249	847	370
16	475	451	739	345	250	435	2200	602	266	292	859	364
17	616	912	888	350	300	430	2000	565	429	304	972	380
18	712	1440	820	390	300	430	1840	531	433	331	1610	494
19	657	1730	720	440	300	430	1690	487	350	281	1640	568
20	581	1450	760	410	300	430	1520	455	302	279	1410	650
21	617	1080	810	370	250	435	1370	451	251	278	1090	768
22	595	1120	830	360	220	440	1250	437	236	256	690	760
23	577	921	900	380	300	460	1220	434	184	220	655	769
24	584	909	830	370	300	500	1170	419	203	184	582	630
25	591	832	740	360	300	580	1120	402	178	177	541	546
26	634	735	500	360	300	700	1080	393	166	194	533	517
27	665	691	540	370	300	850	964	407	212	215	514	604
28	661	631	560	380	300	1000	953	423	228	236	504	657
29	631	714	620	380	300	1150	952	417	224	227	476	612
30	615	942	470	380	---	1250	880	394	217	214	458	576
31	580	---	430	380	---	1400	---	365	---	168	435	---
TOTAL	17372	22051	25019	11200	9075	16350	79189	17066	7656	6894	19052	17239
MEAN	560	735	807	361	313	527	2640	551	255	222	615	575
MAX	716	1730	1380	440	380	1400	6220	850	433	331	1640	999
MIN	303	375	430	305	220	230	880	365	166	153	157	364
CFSM	.64	.85	.93	.42	.36	.61	3.03	.63	.29	.26	.71	.66
IN.	.74	.94	1.07	.48	.39	.70	3.39	.73	.33	.29	.81	.74

CAL YR 1987 TOTAL 200937 MEAN 551 MAX 1730 MIN 183 CFSM .63 IN 8.59
WTR YR 1988 TOTAL 248163 MEAN 678 MAX 6220 MIN 153 CFSM .78 IN 10.61

04059000 ESCANABA RIVER AT CORNELL, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1969-73, 1975 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1975 to September 1981.
WATER TEMPERATURE: February 1975 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 15, 1975 to Sept. 30, 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at or near bridge. From October 1975 to September 1981, instrument-recorded specific conductance below 200 microsiemens does not represent the conductance of the cross section. Results of a study of conductance in the cross section are available in the District files.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975, 1978-81): Maximum daily recorded (more than 20 percent missing record), 360 microsiemens, Sept. 10, 1975; minimum measured, 114 microsiemens, Apr. 15, 1981.
WATER TEMPERATURE (water years 1975, 1977-81): Maximum daily recorded (more than 20 percent missing record), 35.0°C, July 31, 1975; minimum, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 72 microsiemens was measured Apr. 24, 1985.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND ARD UNITS)	TEMPER ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 27...	1130	663	202	8.30	5.0	1.7	12.4	101	K8	K12
DEC 29...	1340	810	237	8.10	0.0	1.6	14.5	101	K4	490
MAR 08...	1430	326	300	8.10	0.0	1.6	12.3	88	K2	K4
MAY 04...	1400	667	165	8.42	16.0	0.70	10.4	109	K10	<5
JUN 27...	1440	244	325	8.80	24.5	1.3	9.1	113	K12	K63
AUG 29...	1415	490	227	8.57	18.0	1.5	9.8	107	K9	K30

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 27...	99	2	24	9.5	7.2	14	0.3	0.90	119	0
DEC 29...	95	0	23	9.2	15	25	0.7	1.0	121	0
MAR 08...	110	0	24	11	29	37	1	1.5	164	0
MAY 04...	80	6	19	7.8	5.3	13	0.3	0.90	86	2
JUN 27...	120	0	27	12	34	38	1	1.4	173	12
AUG 29...	88	0	20	9.3	19	32	0.9	1.1	107	6

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 27...	97	11	3.6	0.10	8.2	138	0.19	247	<0.010	0.110
DEC 29...	99	16	5.7	0.20	10	148	0.20	324	<0.010	0.170
MAR 08...	134	18	7.9	0.20	13	180	0.24	158	<0.010	0.220
MAY 04...	74	16	3.6	0.10	4.7	113	0.15	204	<0.010	<0.100
JUN 27...	152	29	8.7	0.40	8.8	213	0.29	140	<0.010	<0.100
AUG 29...	98	14	7.3	0.10	9.7	157	0.21	208	<0.010	<0.100

04059000 ESCANABA RIVER AT CORNELL, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT										
27...	0.020	0.020	0.80	--	0.030	0.010	20	<1	10	<0.5
DEC										
29...	0.030	0.030	0.30	0.010	<0.010	<0.010	<10	1	11	<0.5
MAR										
08...	0.030	0.030	0.30	0.030	0.020	<0.010	--	--	--	--
MAY										
04...	0.020	0.020	0.50	0.020	<0.010	<0.010	20	1	9	<0.5
JUN										
27...	0.020	<0.010	0.50	0.010	0.010	0.020	10	2	11	<0.5
AUG										
29...	0.040	--	0.60	0.020	<0.010	0.020	--	--	--	--

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT										
27...	<1	<1	<3	2	380	<5	<4	12	<0.1	<10
DEC										
29...	<1	<1	<3	7	410	<5	<4	<1	<0.1	<10
MAR										
08...	--	--	--	--	--	--	--	--	--	--
MAY										
04...	<1	<1	<3	2	220	<5	9	13	<0.1	<10
JUN										
27...	<1	1	<3	1	35	<5	6	30	<0.1	<10
AUG										
29...	--	--	--	--	--	--	--	--	--	--

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT									
27...	2	<1	<1.0	32	<6	5	3	5.4	82
DEC									
29...	3	<1	<1.0	48	<6	<3	3	6.6	100
MAR									
08...	--	--	--	--	--	--	2	1.8	100
MAY									
04...	1	<1	<1.0	44	<6	5	4	7.2	100
JUN									
27...	2	<1	<1.0	54	<6	9	4	2.6	89
AUG									
29...	--	--	--	--	--	--	3	4.0	83

04059500 FORD RIVER NEAR HYDE, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°45'20", long 87°12'05", in SW1/4 sec.19, T.39 N., R.23 W., Delta County, Hydrologic Unit 04030109, on right bank 40 ft downstream from bridge on County Road 533, 1.4 mi downstream from Tenmile Creek, and 1.5 mi north of Hyde.

DRAINAGE AREA.--450 mi^2.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1954 to current year.

GAGE.--Water-stage recorder. Datum of gage is 681.77 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 22, 23, 27, 28, Dec. 1-15 and Dec. 17 to Apr. 3. Water-discharge records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--34 years, 363 ft^3/s, 11.56 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,590 ft^3/s, May 7, 1960, gage height, 8.27 ft; minimum, 18 ft^3/s, Aug. 30, 1976, July 7, 8, 1988; minimum gage height, 1.30 ft, July 7, 8, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,390 ft^3/s, Apr. 5, gage height, 5.99 ft; maximum gage height, 7.06 ft, Mar. 31, backwater from ice; minimum discharge, 18 ft^3/s, July 7, 8, gage height, 1.30 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	115	210	470	140	78	65	1250	422	99	27	23	83
2	119	200	428	125	77	64	1450	377	90	26	21	77
3	129	195	295	117	76	64	2000	340	82	25	21	81
4	136	214	270	113	75	64	2870	315	77	24	21	85
5	134	248	260	110	74	64	3150	294	73	23	32	88
6	136	251	250	107	73	64	3100	274	70	21	40	119
7	144	244	250	104	72	65	2940	253	65	20	69	143
8	153	236	240	102	71	68	2730	239	62	21	107	133
9	168	219	330	100	70	77	2440	239	59	27	103	112
10	165	200	410	95	70	86	2150	238	55	35	82	94
11	152	175	450	93	69	91	1850	246	57	49	70	83
12	140	160	440	91	68	91	1580	256	55	39	64	77
13	131	158	390	90	68	89	1350	269	54	32	59	75
14	122	159	320	89	67	88	1160	264	50	32	67	68
15	117	154	280	88	67	87	985	272	46	35	71	64
16	119	149	252	90	67	86	867	281	44	46	142	62
17	152	266	240	92	67	85	776	260	42	46	175	63
18	200	506	235	93	68	84	717	232	40	52	165	61
19	242	638	230	94	70	83	653	205	40	55	212	73
20	235	682	230	94	70	82	597	186	40	54	241	104
21	215	524	225	94	69	81	544	169	37	48	234	122
22	203	450	220	93	68	80	500	155	50	41	182	167
23	205	500	215	93	68	79	476	142	43	40	158	196
24	217	521	210	92	68	82	470	132	41	46	126	195
25	225	439	205	90	67	110	457	122	40	41	116	176
26	227	375	195	89	67	250	442	120	37	33	106	162
27	237	305	180	86	66	380	453	126	33	31	101	140
28	248	320	170	84	66	500	502	130	32	31	97	147
29	248	369	168	83	65	730	481	128	31	27	93	160
30	243	452	166	81	---	1200	444	125	29	26	93	155
31	228	---	160	80	---	1300	---	114	---	23	88	---
TOTAL	5505	9519	8384	2992	2021	6339	39384	6925	1573	1076	3179	3365
MEAN	178	317	270	96.5	69.7	204	1313	223	52.4	34.7	103	112
MAX	248	682	470	140	78	1300	3150	422	99	55	241	196
MIN	115	149	160	80	65	64	442	114	29	20	21	61
CFSM	.40	.70	.60	.21	.16	.45	2.92	.50	.12	.08	.23	.25
IN.	.46	.79	.69	.25	.17	.52	3.26	.57	.13	.09	.26	.28

CAL YR 1987 TOTAL 81657 MEAN 224 MAX 856 MIN 50 CFSM .50 IN 6.75
WTR YR 1988 TOTAL 90262 MEAN 247 MAX 3150 MIN 20 CFSM .55 IN 7.46

04059500 FORD RIVER NEAR HYDE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1956 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: December 1974 to September 1981.
WATER TEMPERATURE: July 1956 to September 1981.

INSTRUMENTATION.--Water-temperature recorder from July 20, 1956 to Sept. 30, 1975. Water-quality monitor from Oct. 1, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-77, 1979-81): Maximum, 482 microsiemens, Dec. 2, 1976; minimum recorded, 131 microsiemens, May 22, 1976, but may have been lower during instrument malfunction May 18-21, 1976.
WATER TEMPERATURE (water years 1956-81): Maximum, 31.0°C, July 31, 1975; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 28...	1245	251	274	8.35	3.0	6.6	13.0	100	K18	K8
JAN 28...	1330	84	367	7.80	0.0	0.80	6.7	47	K6	K4
MAY 03...	1145	326	264	8.21	13.0	0.40	10.5	103	K27	K20
JUL 28...	1430	32	320	8.45	28.0	1.0	9.2	122	K21	58

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 28...	160	21	38	17	1.6	2	0.1	0.70	168	4
JAN 28...	220	33	51	22	1.7	2	0.0	0.50	229	0
MAY 03...	150	17	35	14	1.7	2	0.1	0.60	156	0
JUL 28...	190	22	38	22	1.8	2	0.1	1.0	171	14

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 28...	144	11	3.2	0.10	7.7	180	0.24	122	<0.010	<0.100
JAN 28...	188	14	2.3	0.10	11	222	0.30	50.6	<0.010	0.210
MAY 03...	128	--	2.7	0.10	1.8	167	--	--	<0.010	<0.100
JUL 28...	164	13	2.2	<0.10	5.9	194	0.26	16.6	<0.010	<0.100

04059500 FORD RIVER NEAR HYDE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 28...	0.030	0.010	0.50	0.030	<0.010	<0.010	<10	<1	10	<0.5
JAN 28...	0.040	0.020	0.70	0.020	<0.010	<0.010	<10	<1	13	<0.5
MAY 03...	0.150	0.180	0.90	0.030	0.020	<0.010	<10	<1	11	<0.5
JUL 28...	<0.010	<0.010	0.50	0.020	0.010	<0.010	<10	<1	13	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 28...	<1	<1	<3	<1	100	<5	<4	4	<0.1	<10
JAN 28...	<1	<1	<3	3	130	<5	<4	12	<0.1	<10
MAY 03...	<1	<1	<3	2	54	<5	9	15	<0.1	<10
JUL 28...	<1	<1	<3	<1	24	<5	<4	14	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 28...	<1	<1	<1.0	45	<6	<3	2	1.4	88
JAN 28...	1	<1	<1.0	59	<6	3	2	0.46	100
MAY 03...	<1	<1	<1.0	42	<6	5	3	2.6	100
JUL 28...	<1	<1	1.0	69	<6	<3	2	0.17	50

04061000 BRULE RIVER NEAR FLORENCE, WI

LOCATION.--Lat 45°57'31", long 88°15'57", in SE1/4 SE1/4 sec.11, T.41 N., R.3. W., Michigan Meridian, Iron County, Hydrologic Unit 04030106, on left bank 40 ft upstream from highway bridge, 1.0 mi upstream from Paint River, 2.5 mi north of Florence, WI, and 5.0 mi upstream from confluence with Michigamme River.

DRAINAGE AREA.--389 mi².

PERIOD OF RECORD.--January 1914 to February 1916, June 1944 to current year.

REVISED RECORDS.--WSP 1387: 1914-16. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,200.55 ft above National Geodetic Vertical Datum of 1929 (levels by Owen Ayres Associates). Prior to Aug. 29, 1944, nonrecording gage at bridge 40 ft downstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 21-28 and Dec. 3 to Apr. 2. Records excellent except for estimated daily discharges, which are fair. Discharge includes some mine pumpage prior to August 1977. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--45 years (water years 1915, 1945-88), 361 ft³/s, 12.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,700 ft³/s, July 2, 1953, gage height, 6.57 ft; maximum gage height, 8.60 ft, Dec. 20, 1983, backwater from ice; minimum discharge, 118 ft³/s, Dec. 2, 1963 (discharge measurement); minimum gage height, 1.76 ft, July 29, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,100 ft³/s, Apr. 7, gage height, 3.47 ft; maximum gage height, 5.93 ft, Jan. 3, backwater from ice; minimum discharge, 154 ft³/s, July 29, gage height, 1.76 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	189	227	314	215	190	205	570	270	213	188	163	164
2	210	225	286	215	190	210	580	262	197	181	162	166
3	224	233	215	210	185	215	581	254	193	184	167	208
4	215	263	240	210	185	215	781	252	192	176	197	360
5	210	274	250	210	185	215	911	254	188	169	293	325
6	218	256	250	210	190	220	1060	254	184	165	258	280
7	236	244	260	205	190	230	1080	247	182	162	208	240
8	231	237	270	205	195	235	913	251	182	160	187	215
9	228	232	285	205	200	240	723	270	186	191	177	199
10	221	226	305	205	200	235	610	301	181	206	172	187
11	212	227	290	205	200	230	541	301	178	192	165	177
12	207	225	265	210	200	230	482	279	177	180	169	176
13	206	224	255	210	200	230	435	289	173	173	210	184
14	204	221	250	210	200	230	409	276	170	170	220	182
15	213	219	250	210	200	240	378	259	169	221	207	177
16	323	229	250	210	200	245	356	251	170	382	186	179
17	382	333	250	210	200	255	341	244	170	279	223	228
18	332	435	250	210	200	250	333	239	169	222	245	246
19	289	382	250	210	200	250	325	232	179	201	225	232
20	279	316	250	210	195	250	307	226	185	187	195	267
21	266	275	245	215	195	240	293	229	174	185	178	272
22	264	285	240	215	195	250	284	263	275	191	169	266
23	266	300	235	215	190	260	288	265	299	183	185	253
24	264	300	230	215	190	265	304	264	228	176	208	232
25	258	300	230	215	190	300	304	233	207	177	194	215
26	254	300	225	215	190	650	297	223	195	178	183	208
27	262	300	225	215	195	600	296	218	184	170	176	213
28	259	300	220	210	195	520	303	223	187	164	175	204
29	253	284	220	208	195	520	289	217	215	158	172	200
30	240	335	220	200	---	525	277	212	208	168	170	210
31	234	---	215	195	---	540	---	213	---	164	164	---
TOTAL	7649	8207	7740	6503	5640	9300	14651	7771	5810	5903	6003	6665
MEAN	247	274	250	210	194	300	488	251	194	190	194	222
MAX	382	435	314	215	200	650	1080	301	299	382	293	360
MIN	189	219	215	195	185	205	277	212	169	158	162	164
CFSM	.64	.70	.64	.54	.50	.77	1.25	.65	.50	.49	.50	.57
IN.	.73	.78	.74	.62	.54	.89	1.40	.74	.56	.56	.57	.64

CAL YR 1987 TOTAL 97848 MEAN 268 MAX 592 MIN 185 CFSM .69 IN 9.36
WTR YR 1988 TOTAL 91842 MEAN 251 MAX 1080 MIN 158 CFSM .65 IN 8.78

04061500 PAINT RIVER AT CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'21", long 88°20'05", in SE1/4 sec.20, T.43 N., R.32 W., Iron County, Hydrologic Unit 04030106, on right bank 150 ft downstream from municipal powerplant at Crystal Falls, 14.5 mi upstream from mouth.

DRAINAGE AREA.--597 mi^2.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1174: 1947-48(m). WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,306.1 ft above National Geodetic Vertical Datum of 1929 (Wisconsin Electric Power Co. bench mark).

REMARKS.--Estimated daily discharges: Jan. 6 to Mar. 6. Records good. Diurnal fluctuation caused by powerplant immediately upstream; since storage capacity is small, daily flows are not affected appreciably. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 600 ft^3/s, 13.65 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,900 ft^3/s, Apr. 25, 1960, gage height, 9.82 ft; minimum, 7.7 ft^3/s, Sept. 17, 1950, gage height, 0.89 ft; minimum daily, 81 ft^3/s, Nov. 1, 1947.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,240 ft^3/s, Apr. 7, gage height, 5.30 ft; minimum, 82 ft^3/s, July 29, gage height, 1.48 ft; minimum daily, 91 ft^3/s, July 23.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	259	400	570	348	265	190	644	431	263	278	195	279
2	309	421	492	303	280	190	688	414	291	137	187	296
3	322	398	432	325	270	195	918	407	398	160	261	252
4	312	445	498	312	260	200	1710	372	166	120	361	447
5	364	490	490	295	250	205	2430	367	201	180	460	476
6	378	465	417	300	235	220	2800	369	295	181	464	505
7	388	426	461	275	220	269	3110	344	225	181	329	413
8	429	417	457	270	230	280	3020	284	212	180	357	358
9	459	405	473	260	215	285	2750	418	206	190	276	335
10	421	373	555	255	220	302	2400	400	216	149	259	275
11	387	371	614	250	235	312	2140	450	176	205	250	209
12	367	364	627	240	220	305	1780	447	136	204	264	321
13	357	362	589	240	190	305	1520	422	252	190	249	267
14	350	356	552	230	195	296	1310	466	211	182	241	284
15	363	356	495	225	200	303	1120	415	276	264	344	253
16	489	356	469	230	200	304	988	402	169	199	301	265
17	670	454	431	230	190	308	883	367	174	203	383	276
18	676	655	404	250	195	293	820	357	130	269	573	438
19	597	722	418	225	200	297	764	343	165	199	640	461
20	588	670	460	250	205	287	704	337	308	201	542	422
21	563	517	446	260	200	285	616	322	208	244	441	464
22	570	516	440	270	200	272	572	410	234	304	414	493
23	574	564	434	265	200	286	582	349	227	91	360	441
24	515	544	436	260	195	293	514	379	305	99	364	422
25	481	505	424	290	200	487	557	355	196	187	354	356
26	539	494	356	290	200	555	536	335	119	171	379	391
27	478	461	354	285	185	613	531	333	196	164	293	343
28	485	454	402	290	185	567	507	297	222	181	341	341
29	491	476	397	260	185	556	496	346	201	227	356	363
30	479	553	374	250	---	573	448	233	218	105	297	377
31	450	---	392	235	---	614	---	335	---	98	300	---
TOTAL	14110	13990	14359	8268	6225	10447	37858	11506	6596	5743	10835	10823
MEAN	455	466	463	267	215	337	1262	371	220	185	350	361
MAX	676	722	627	348	280	614	3110	466	398	304	640	505
MIN	259	356	354	225	185	190	448	233	119	91	187	209
CFSM	.76	.78	.78	.45	.36	.56	2.11	.62	.37	.31	.59	.61
IN.	.88	.87	.89	.52	.39	.65	2.36	.72	.41	.36	.68	.67

CAL YR 1987 TOTAL 149200 MEAN 409 MAX 1090 MIN 170 CFSM .69 IN 9.30
WTR YR 1988 TOTAL 150760 MEAN 412 MAX 3110 MIN 91 CFSM .69 IN 9.39

04062000 PAINT RIVER NEAR ALPHA, MI

LOCATION.--Lat 46°00'40", long 88°15'30", in NW1/4 NW1/4 sec.25, T.42 N., R.32 W., Iron County, Hydrologic Unit 04030106, on right bank 0.6 mi downstream from Lower Paint Dam, 5.5 mi upstream from Brule River, and 6.0 mi southeast of Alpha.

DRAINAGE AREA.--631 mi².

PERIOD OF RECORD.--June 1952 to current year. Monthly discharge only for period October 1953 to September 1960, published in WSP 1727.

REVISED RECORDS.--WSP 1727: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,260 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Nov. 21, Dec. 2, 3, 6, and Dec. 14 to Mar. 30. Records good. Flow completely regulated by powerplant and Lower Paint Dam, 0.6 mi upstream. Records not adjusted for diversion to Michigamme River by Paint River Diversion Canal. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--36 years, 173 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,050 ft³/s, July 2, 1953, gage height, 10.50 ft; minimum daily, 62 ft³/s, Mar. 22, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,000 ft³/s, Mar. 31, gage height, 4.79 ft; minimum daily, 82 ft³/s, Apr. 18, 19, Aug. 20-22.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	93	90	88	88	90	87	755	86	86	92	88	86
2	92	90	88	88	90	86	600	86	86	93	94	86
3	95	90	88	88	89	86	584	86	87	93	93	87
4	93	90	88	88	88	86	730	85	88	93	87	89
5	93	90	88	88	87	86	905	85	88	93	90	88
6	93	89	88	88	87	86	598	85	88	93	90	88
7	88	88	89	88	87	87	654	86	88	93	90	88
8	85	88	88	88	87	88	737	86	88	91	89	88
9	95	88	87	88	86	88	581	86	88	90	88	88
10	93	88	86	88	86	89	434	86	87	90	88	89
11	91	88	86	88	86	90	244	86	86	90	88	90
12	90	88	87	88	86	90	88	89	86	90	88	90
13	91	88	87	88	86	89	87	89	96	90	88	90
14	90	88	87	88	86	88	83	86	90	90	86	90
15	91	88	87	88	86	88	84	86	90	90	86	89
16	86	88	86	88	86	88	84	86	90	88	86	89
17	84	90	86	89	86	88	83	86	90	88	87	93
18	84	89	86	90	87	88	82	86	90	89	86	93
19	89	89	86	92	88	88	82	86	90	89	84	93
20	90	88	86	92	88	88	92	86	90	89	82	93
21	90	88	86	91	88	88	86	86	91	90	82	90
22	90	88	86	91	88	88	85	86	122	90	82	90
23	90	88	86	91	88	88	86	86	93	88	91	91
24	90	88	86	91	88	88	86	86	93	88	86	93
25	90	88	86	91	88	88	85	86	93	88	86	92
26	90	88	86	91	88	88	84	86	93	88	86	91
27	90	89	86	91	88	88	84	86	93	88	87	90
28	89	87	86	91	88	88	84	86	93	88	86	90
29	88	88	86	91	88	88	93	86	93	89	86	90
30	89	88	86	91	---	88	86	86	93	88	86	92
31	90	---	86	91	---	411	---	86	---	88	86	---
TOTAL	2792	2655	2688	2772	2534	3045	8446	2669	2729	2787	2702	2696
MEAN	90.1	88.5	86.7	89.4	87.4	98.2	282	86.1	91.0	89.9	87.2	89.9
MAX	95	90	89	92	90	411	905	89	122	93	94	93
MIN	84	87	86	88	86	86	82	85	86	88	82	86

CAL YR 1987 TOTAL 34464 MEAN 94.4 MAX 707 MIN 78
WTR YR 1988 TOTAL 38515 MEAN 105 MAX 905 MIN 82

04062228 LAKE MICHIGAMME NEAR CHAMPION, MI

LOCATION.--Lat 46°31'39", long 88°00'15", in NE1/4 SW1/4 sec.25, T.48 N., R.30 W., Marquette County, Hydrologic Unit 04030107, on left bank 60 ft downstream from railroad bridge, at mouth of Peshekee River, 2.1 mi northwest of Champion.

DRAINAGE AREA.--193 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,548.83 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 8, 1962, nonrecording gage at same site and datum.

REMARKS.--Major inlets to Lake Michigamme are Peshekee River and Spurr River. The outlet is Michigamme River. Streamflow records were collected for Michigamme River (station 04062230) from October 1968 to September 1982 and for Peshekee River (station 04062200) from July 1961 to September 1978. It has been determined that the gage records river stage rather than lake stage when the lake stage falls below a gage height of about 0.10 ft. This last occurred during the 1976 and 1977 water years. Lake stage for this period was determined on the basis of stage-discharge relation at the lake outlet using discharge figures from station 04062230. Surface area of lake is 4,260 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 8.49 ft, Apr. 21, 22 or 23, 1985, from floodmark; minimum, -0.50 ft, Sept. 30, Oct. 1, 1976.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 5.32 ft, Apr. 12; minimum, 0.61 ft, July 31, Aug. 1

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.86	2.82	2.73	2.38	2.20	---	2.41	3.26	2.04	.95	.62	2.02
2	1.89	2.78	2.75	2.35	2.18	---	2.43	3.22	1.97	.93	.71	1.97
3	2.01	2.75	2.73	2.33	2.17	---	2.48	3.18	1.92	.91	1.19	1.93
4	2.11	2.75	2.73	---	2.14	---	---	3.14	1.88	.90	1.15	1.91
5	2.21	2.72	2.70	---	2.14	---	---	3.08	1.84	.87	1.29	1.90
6	2.30	2.68	2.66	---	2.16	---	3.47	3.01	1.80	.86	1.35	1.88
7	2.43	2.64	2.63	---	2.14	---	3.84	2.95	1.74	.85	1.36	1.86
8	2.57	2.61	2.59	---	2.13	---	4.35	2.90	1.67	.81	1.36	1.82
9	2.67	2.58	2.63	---	2.10	---	4.81	2.85	1.63	.80	1.36	1.82
10	2.72	2.53	2.71	---	2.08	---	5.11	2.80	1.59	.79	1.36	1.75
11	2.76	2.50	2.78	---	2.05	---	5.28	2.73	1.56	.76	1.34	1.71
12	2.75	2.45	2.82	---	2.03	---	5.31	2.68	1.52	.75	1.33	1.69
13	2.74	2.42	2.84	---	2.02	---	5.29	2.68	1.48	.74	1.35	1.67
14	2.70	2.37	2.84	2.20	2.00	---	5.24	2.62	1.46	.73	1.44	1.61
15	2.66	2.35	2.83	2.19	2.00	---	5.17	2.60	1.42	.73	1.37	1.58
16	2.72	2.34	2.84	2.18	1.98	---	5.01	2.55	1.36	.75	1.40	1.56
17	2.83	2.44	2.80	2.16	1.97	---	4.82	2.50	1.34	.74	1.73	1.58
18	2.91	2.60	2.77	2.13	1.94	---	4.65	2.46	1.32	.73	2.00	1.57
19	2.95	2.74	2.75	2.12	1.93	---	4.48	2.41	1.32	.71	2.16	1.58
20	2.95	2.80	2.74	2.13	1.93	---	4.31	2.36	1.27	.69	2.25	1.62
21	2.95	2.82	2.71	2.15	1.92	---	4.13	2.33	1.24	.68	2.28	1.60
22	2.93	2.82	2.67	2.17	1.92	---	3.95	2.31	1.21	.69	2.26	1.61
23	2.91	2.82	2.64	2.18	1.93	---	3.79	2.29	1.17	.68	2.26	1.64
24	2.90	2.80	2.61	2.18	---	---	3.66	2.24	1.15	.66	2.25	1.60
25	2.88	2.76	2.59	2.18	---	---	3.54	2.20	1.15	.68	2.23	1.58
26	2.87	2.72	2.55	2.17	---	---	3.45	2.18	1.09	.67	2.20	1.62
27	2.88	2.68	2.51	2.16	---	---	3.39	2.17	1.07	.66	2.19	1.69
28	2.89	2.64	2.48	2.16	---	---	3.36	2.15	1.05	.66	2.18	1.71
29	2.89	2.64	2.44	2.17	---	---	3.32	2.14	1.00	.64	2.13	1.74
30	2.88	2.68	2.41	2.17	---	2.42	3.29	2.11	.97	.63	2.09	1.77
31	2.86	---	2.40	2.19	---	2.42	---	2.08	---	.62	2.05	---
MEAN	2.66	2.64	2.67	---	---	---	---	2.59	1.44	.75	1.69	1.72
MAX	2.95	2.82	2.84	---	---	---	---	3.26	2.04	.95	2.28	2.02
MIN	1.86	2.34	2.40	---	---	---	---	2.08	.97	.62	.62	1.56

04062500 MICHIGAMME RIVER NEAR CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'50", long 88°12'57", in NW1/4 sec.20, T.43 N., R.31 W., Iron County, Hydrologic Unit 04030107, on right bank 400 ft upstream from highway bridge, 5.0 mi downstream from Michigamme Reservoir, 6.0 mi east of Crystal Falls, and 15 mi upstream from confluence with Brule River.

DRAINAGE AREA.--656 mi^2.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,300 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: July 3-8 and Mar. 1, 3-5, 15, 17, 19-21. Records excellent. Flow regulated by powerplant and by Michigamme Reservoir, capacity, 119,950 acre-ft, 5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 711 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,260 ft^3/s, Apr. 28, 1960, gage height, 10.73 ft; minimum daily, 71 ft^3/s, Nov. 26, 1950.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,440 ft^3/s, Apr. 5, gage height, 5.27 ft; minimum daily, 111 ft^3/s, June 23.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	156	157	986	163	1190	405	1320	179	590	602	511	1080
2	157	337	988	703	1260	389	1270	513	588	602	547	864
3	156	419	1010	1120	1250	385	1270	705	165	600	600	686
4	156	418	1100	1120	1240	375	1340	619	159	600	243	375
5	157	416	1110	1120	1230	360	1320	442	160	600	154	145
6	159	306	1100	1130	1220	355	893	425	384	600	143	428
7	158	155	1100	1130	1210	353	981	164	403	600	137	596
8	157	153	1100	1120	1200	376	528	167	407	704	134	594
9	159	328	1030	1120	1190	422	160	373	168	372	181	592
10	157	397	1170	1110	1170	428	183	347	429	146	612	331
11	158	398	1170	1110	1160	436	178	351	339	433	572	201
12	159	286	1170	1120	1150	414	175	170	444	607	541	465
13	158	166	1160	1240	1130	405	174	171	329	601	149	591
14	160	165	1160	1240	1120	399	174	168	444	499	233	590
15	164	156	1160	1230	829	400	174	167	180	566	605	589
16	168	146	1160	1220	1100	245	172	518	456	377	623	580
17	166	161	1160	1220	1080	125	160	719	333	141	622	595
18	165	159	1060	1210	1060	137	145	646	442	138	615	353
19	164	156	960	1210	1040	142	149	582	168	138	667	175
20	164	154	959	1200	1040	147	153	580	430	502	684	175
21	164	152	1070	1010	1040	151	159	580	494	606	680	173
22	166	330	1170	1170	994	155	158	476	147	603	680	179
23	166	683	1170	1120	900	158	163	423	111	315	681	175
24	166	992	1170	1110	848	162	163	571	136	136	681	172
25	165	993	1160	1110	782	178	164	572	139	389	681	173
26	168	993	1160	1150	737	179	162	574	136	602	679	175
27	169	991	1160	1180	552	429	491	486	315	600	681	166
28	163	990	1150	1170	434	735	835	162	608	600	679	437
29	157	999	1150	1020	408	972	458	166	606	351	878	620
30	157	994	1150	1160	---	1320	200	165	602	142	1070	596
31	156	---	571	1160	---	1350	---	443	---	140	1080	---
TOTAL	4995	13150	33894	34196	29564	12487	13892	12624	10312	13912	17043	12871
MEAN	161	438	1093	1103	1019	403	463	407	344	449	550	429
MAX	169	999	1170	1240	1260	1350	1340	719	608	704	1080	1080
MIN	156	146	571	163	408	125	145	162	111	136	134	145

CAL YR 1987 TOTAL 195863 MEAN 537 MAX 1170 MIN 116
WTR YR 1988 TOTAL 208940 MEAN 571 MAX 1350 MIN 111

04063000 MENOMINEE RIVER NEAR FLORENCE, WI

LOCATION.--Lat 45°57'04", long 88°11'13", in NE1/4 sec.16, T.41 N., R.31 W., Michigan Meridian, Iron County, Hydrologic Unit 04030108, on left bank 0.5 mi downstream from confluence of Brule and Michigamme Rivers, 3.5 mi northeast of Florence, WI, and at mile 117.

DRAINAGE AREA.--1,780 mi^2.

PERIOD OF RECORD.--January 1914 to current year. Published as "at Twin Falls near Iron Mountain, MI" 1914-57. Records published for both sites July 1950 to September 1957.

REVISED RECORDS.--WSP 1707: 1953(M). WSP 1911: Drainage area of former site.

GAGE.--Water-stage recorder. Datum of gage is 1,119.23 ft above National Geodetic Vertical Datum of 1929 (levels by Owen Ayres Associates). Prior to July 1950, headwater and tailwater gages and generation data entered hourly in daily log sheets by company employees at the Twin Falls Powerplant of Wisconsin Electric Power Co., 10.4 mi downstream.

REMARKS.--No estimated daily discharges. Records excellent. Prior to July 1950, discharge determined from powerplant records computed on basis of load-discharge rating of hydroelectric units and rating for tailwater gage during periods of spill. Rating developed by U.S. Geological Survey. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--74 years, 1,815 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,500 ft^3/s, Apr. 26, 1960, gage height, 14.15 ft; minimum, 38 ft^3/s, Aug. 21, 1962, Sept. 26, 1975; minimum gage height, 1.18 ft, Aug. 21, 1962, Nov. 4, 1965; minimum daily discharge, 57 ft^3/s, Sept. 26, 1975.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,610 ft^3/s, Apr. 7, gage height, 6.67 ft; minimum, 87 ft^3/s, May 13, gage height, 1.44 ft; minimum daily, 508 ft^3/s, Apr. 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	756	873	1890	890	1780	1400	2550	883	974	1000	583	1510
2	766	1040	1890	1500	1820	1430	2790	1480	895	861	661	1380
3	750	1470	1750	1470	1820	1420	3000	1610	853	677	758	937
4	725	1380	2070	1800	1870	1450	3440	1280	841	980	802	1730
5	603	1160	1800	1770	1830	1460	3510	1150	697	914	1090	1150
6	635	1140	1860	1960	1630	1470	3560	1080	732	994	1270	1320
7	667	806	1910	1440	1670	1510	3830	673	764	1050	994	1380
8	753	757	1860	1780	1760	1520	3770	852	666	999	937	1100
9	872	1060	2040	1520	1790	1420	3360	998	702	935	706	1150
10	917	1170	2270	1690	1690	1480	3080	934	742	752	733	924
11	864	1180	2220	1510	1760	1450	2580	1070	903	827	772	853
12	733	1170	2160	1700	1730	1470	2350	776	866	1040	716	728
13	930	855	2100	1870	1520	1420	1950	984	762	986	693	908
14	730	775	1850	1940	1480	1530	1500	828	773	1080	714	1200
15	691	820	1900	1940	1740	1420	1500	900	730	932	1010	1130
16	948	977	1890	1940	1480	1490	1250	1360	741	776	1520	1020
17	1270	1240	1940	1910	1540	1140	1120	1370	789	655	1550	937
18	1450	1290	1950	1910	1630	1100	1030	1520	859	714	1940	854
19	1200	1450	1840	1700	1430	1100	1000	1440	835	961	1920	808
20	1170	1660	1730	1640	1420	1040	841	1290	872	1020	1400	936
21	1280	1170	1930	1660	1490	1080	924	1040	826	941	1410	1200
22	1120	1180	1870	1690	1600	1120	845	1010	787	900	1300	1290
23	1180	1770	1900	1750	1600	1170	655	1170	818	734	1280	1110
24	1060	1890	1830	1660	1270	1250	508	1140	763	716	1090	777
25	1150	1770	1980	1650	1710	1590	599	1210	573	878	1110	774
26	1050	1950	1940	1720	1530	1930	1010	1290	844	824	1410	1040
27	1100	1970	1860	1660	1470	2110	1160	1280	753	781	1280	1260
28	1000	1900	2000	1690	1420	2060	1680	791	751	822	1290	943
29	969	1820	1820	1650	1360	2280	1470	982	880	809	1310	1070
30	915	1840	1960	1620	---	2430	753	910	967	759	1820	1040
31	903	---	1020	1740	---	2580	---	1020	---	727	1570	---
TOTAL	29157	39533	59030	52370	46860	47320	57615	34321	23958	27044	35639	32459
MEAN	941	1318	1904	1689	1616	1526	1921	1107	799	872	1150	1082
MAX	1450	1970	2270	1960	1870	2580	3830	1610	974	1080	1940	1730
MIN	603	757	1020	890	1270	1040	508	673	573	655	583	728

CAL YR 1987 TOTAL 475210 MEAN 1302 MAX 3140 MIN 356
WTR YR 1988 TOTAL 485306 MEAN 1326 MAX 3830 MIN 508

04065722 MENOMINEE RIVER NEAR VULCAN, MI

LOCATION.--Lat 45°44'12", long 87°51'48", sec.34, T.39 N., R.29 W., Michigan Meridian, Dickinson County, Hydrologic Unit 04030108, on left bank 0.35 mi downstream from Sturgeon Falls Dam, 3.0 mi south of Vulcan, and at mile 78.7.

DRAINAGE AREA.--2,900 mi².

PERIOD OF RECORD.--December 1987 to September 1988.

GAGE.--Water-stage recorder. Elevation of gage is 820 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 26, 27, 30, and Jan. 1-28. Records excellent except for estimated daily discharges, which are fair. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period December to September, 7,650 ft³/s, Apr. 8, gage height, 10.86 ft; minimum, 815 ft³/s, Aug. 3, 4, gage height, 4.67 ft; minimum daily, 846 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1			2980	1400	2030	1750	4270	1760	1260	1220	958	1580
2			2610	2000	2240	1610	4630	1850	1430	978	946	1590
3			2300	1800	2200	1690	5330	2310	1170	933	846	1550
4			2350	2500	2320	1790	6610	2260	1100	1040	880	1880
5			2500	2900	2350	1780	6790	1870	1080	1130	1130	1900
6			2380	2500	2100	1760	6880	1650	997	1130	1620	1870
7			2530	2100	2100	1760	7210	1420	1030	1080	1410	1690
8			2570	2200	2260	1750	7130	1390	996	1180	1250	1710
9			2660	2100	2180	1880	6590	1700	988	1190	1060	1600
10			2900	2100	2220	1880	5850	1690	988	1170	1020	1250
11			2980	2100	2130	1950	5060	1710	988	1140	978	1130
12			2940	2200	2140	1810	4380	1770	992	1170	973	1210
13			2870	2250	2170	1930	3960	1730	1020	1250	976	1050
14			2470	2250	1950	1950	3130	1570	1010	1220	1100	1210
15			2530	2300	1770	1790	2960	1570	1000	1170	1290	1230
16			2450	2400	1980	1780	2890	1730	997	1270	1480	1270
17			2400	2350	1770	1730	2560	2360	979	1100	2030	1270
18			2210	2600	1940	1630	2240	2050	971	1130	2210	1180
19			2280	2200	1770	1450	1760	1900	974	1150	2250	1270
20			2190	2150	1590	1470	1690	1970	996	1160	2060	1290
21			2360	2150	1880	1600	1910	1750	1060	1170	1970	1590
22			2500	2200	1720	1490	1690	1600	1210	1250	1520	1660
23			2330	2150	1730	1630	1500	1640	1170	1060	1490	1550
24			2430	2100	1860	1710	1480	1640	1080	981	1390	1400
25			2450	2050	1700	1890	1590	1460	1060	972	1430	1260
26			2500	2050	1780	3090	1720	1590	1030	996	1410	1360
27			2600	2050	1730	3190	1930	1720	996	984	1510	1320
28			2170	2100	1800	3270	2520	1440	991	981	1600	1400
29			2210	2160	1540	3510	2460	1380	1110	981	1430	1490
30			2200	2060	---	4070	1780	1330	1200	966	1840	1310
31			2090	2070	---	3970	---	1510	---	958	1840	---
TOTAL			76940	67540	56950	64560	110520	53320	31873	34110	43897	43070
MEAN			2482	2179	1964	2083	3684	1720	1062	1100	1416	1436
MAX			2980	2900	2350	4070	7210	2360	1430	1270	2250	1900
MIN			2090	1400	1540	1450	1480	1330	971	933	846	1050

04066003 MENOMINEE RIVER BELOW PEMENE CREEK NEAR PEMBINE, WI

LOCATION.--Lat 45°34'46", long 87°47'13", in NE1/4 sec.29, T.37 N., R.28 W., Michigan Meridian, Menominee County, Hydrologic Unit 04030108, on left bank 40 ft downstream from County Trunk Z bridge, 0.9 mi downstream from Pemene Creek, 3.9 mi west of Nathan, 10.6 mi southeast of Pembine, WI, and at mile 64.3.

DRAINAGE AREA.--3,140 mi².

PERIOD OF RECORD.--October 1949 to current year. Published as "near Pembine, WI" prior to August 1982. Monthly discharge only for some periods, published in WSP 1307.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above National Geodetic Vertical Datum of 1929, from topographic map. October 1949 to Oct. 27, 1972, water-stage recorder at site 1.0 mi upstream at different datum, and Oct. 28, 1972, to August 1982, water-stage recorder at site 1.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 17 to Mar. 26. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station.

AVERAGE DISCHARGE.--39 years, 2,982 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26,900 ft³/s, May 8, 1960, gage height, 13.90 ft, site and datum then in use; minimum, 694 ft³/s, Sept. 3, 1969, gage height, 1.66 ft, site and datum then in use.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,230 ft³/s, Apr. 7, gage height, 11.21 ft; maximum gage height, 13.38 ft, Dec. 27, backwater from ice; minimum daily discharge, 952 ft³/s, Aug. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1070	1350	3140	1300	1800	1500	4650	1890	1350	1340	1070	1700
2	1080	1520	2940	1200	1700	1500	5080	1830	1360	1180	1160	1630
3	1190	2110	2680	1800	1900	1500	5750	2380	1360	1010	1090	1550
4	1120	2160	2570	1600	1800	1600	7330	2440	1190	1030	952	1850
5	1190	1920	2580	1600	1800	1600	7600	2020	1150	1230	1060	2160
6	1140	1900	2730	1900	1700	1600	7650	1730	1110	1150	1500	1970
7	1070	1640	2640	1800	1600	1500	7950	1690	1110	1190	1810	1730
8	1080	1460	2730	1600	1600	1500	7900	1450	1100	1160	1330	1840
9	1240	1550	2690	1400	1700	1600	7200	1650	1080	1230	1300	1700
10	1280	1860	3040	1400	1800	1800	6310	1790	1070	1300	1170	1390
11	1290	1810	3140	1500	1700	1800	5660	1760	1080	1220	1070	1230
12	1300	1580	3130	1600	1700	1800	4890	1870	1080	1240	1070	1300
13	1250	1580	3090	1700	1600	1700	4250	1910	1120	1320	1100	1120
14	1300	1480	2660	1700	1500	1700	3590	1800	1140	1340	1210	1180
15	1240	1290	2680	1700	1400	1700	3170	1610	1110	1310	1450	1310
16	1220	1430	2610	1800	1500	1700	3200	1710	1100	1400	1430	1390
17	1560	2100	2500	2100	1600	1800	2860	2270	1090	1350	1980	1430
18	2160	2770	2300	2000	1700	1500	2580	2160	1090	1180	2470	1210
19	1980	2900	2300	1900	1700	1500	2170	1970	1120	1280	2370	1430
20	1880	3000	2300	1800	1500	1300	1860	2020	1100	1300	2260	1260
21	1920	2780	2400	1800	1600	1400	1940	1900	1100	1250	2020	1550
22	2000	2130	2500	1800	1600	1500	1870	1690	1220	1300	1700	1790
23	1920	2270	2600	1900	1600	1600	1710	1630	1310	1260	1590	1710
24	1830	2990	2400	1800	1700	1900	1650	1700	1170	1160	1470	1540
25	1790	2780	2500	1700	1500	2200	1690	1500	1160	1140	1530	1430
26	1780	2780	2300	1700	1600	3000	1700	1560	1150	1100	1440	1430
27	1920	2810	2200	1700	1600	3660	1990	1720	1110	1070	1550	1490
28	1870	2800	2300	1800	1500	3380	2660	1590	1090	1050	1890	1500
29	1630	2690	2100	1800	1500	3660	2750	1420	1080	1050	1510	1450
30	1620	2840	2300	1800	---	4430	2120	1340	1250	1040	1720	1470
31	1620	---	2200	1800	---	4380	---	1490	---	1040	2060	---
TOTAL	46540	64280	80250	53000	47500	63310	121730	55490	34550	37220	47332	45740
MEAN	1501	2143	2589	1710	1638	2042	4058	1790	1152	1201	1527	1525
MAX	2160	3000	3140	2100	1900	4430	7950	2440	1360	1400	2470	2160
MIN	1070	1290	2100	1200	1400	1300	1650	1340	1070	1010	952	1120

CAL YR 1987 TOTAL 711530 MEAN 1949 MAX 4200 MIN 1040
WTR YR 1988 TOTAL 696942 MEAN 1904 MAX 7950 MIN 952

04067500 MENOMINEE RIVER NEAR McALLISTER, WI

LOCATION.--Lat 45°19'33", long 87°39'48", in SW1/4 SE1/4 sec.17, T.33 N., R.23 E., Marinette County, WI, Hydrologic Unit 04030108, on right bank 85 ft downstream from bridge on County Highway JJ, 2.9 mi downstream from Grand Rapids Dam, 2.6 mi east of McAllister, WI, 1.9 mi downstream from Little Cedar River, and at mile 22.6.

DRAINAGE AREA.--3,930 mi².

PERIOD OF RECORD.--March 1945 to September 1961, October 1961 to September 1979 (miscellaneous measurements and annual maximums only), October 1979 to September 1986, October 1986 to March 1987 (crest-stage partial-record station), April to September 1988.

REVISED RECORDS.--WDR WI-80-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 622.20 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Transportation reference mark). Prior to May 15, 1945, nonrecording gage 1,400 ft downstream at same datum; May 16, 1945, to September 1961, water-stage recorder 1,000 ft downstream at same datum; October 1961 to September 1979, crest-stage gage 1,100 ft downstream at same datum. October 1979 to September 1986, water-stage recorder at same site and datum; October 1986 to March 1987, crest-stage gage at same site and datum.

REMARKS.--Estimated daily discharges: Apr. 1-21. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on the Michigamme River, and by many smaller reservoirs upstream from station.

AVERAGE DISCHARGE.--23 years (water years 1946-61, 1980-86), 3,577 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 32,500 ft³/s, May 9, 1960, gage height, 20.0 ft, from graph based on gage readings; minimum observed, 538 ft³/s, Oct. 6, 1946, gage height, 7.29 ft.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge during period April to September, 9,800 ft³/s, Apr. 7; minimum daily, 1,040 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							5800	2970	1700	1210	1100	1910
2							6800	2430	1720	1270	1150	1990
3							7600	2650	1460	1520	1040	1990
4							8800	3000	1490	1150	1370	1510
5							8600	2890	1330	1150	1690	2420
6							9400	2570	1360	1150	1170	2230
7							9800	2170	1280	1460	1310	2240
8							9600	2170	1280	1300	2170	2020
9							9000	2000	1210	1330	1370	1800
10							8000	2310	1270	1310	1360	2300
11							7000	2390	1160	1580	1560	1420
12							6400	2260	1290	1180	1230	1200
13							6000	2490	1160	1470	1470	1590
14							5400	2470	1140	1270	1380	1600
15							3700	2220	1290	1710	1320	1190
16							3400	2080	1180	1730	1930	1180
17							3200	2400	1260	1560	1670	1950
18							3000	2530	1150	1800	2280	1330
19							2800	2590	1150	1190	2800	1220
20							2700	2320	1160	1370	2500	2020
21							2600	2280	1360	1720	2510	1840
22							2540	2170	1300	1330	2170	1320
23							2470	2090	1260	1750	2030	2090
24							2650	1900	1530	1190	1800	2100
25							2420	1940	1250	1190	1500	1350
26							2350	1850	1150	1410	1860	1970
27							2580	1780	1160	1330	1700	1390
28							3030	1970	1240	1330	1470	1570
29							3700	2000	1290	1310	2350	2010
30							3560	1680	1300	1200	1640	1610
31							---	1390	---	1130	1800	---
TOTAL							154900	69960	38880	42600	52700	52360
MEAN							5163	2257	1296	1374	1700	1745
MAX							9800	3000	1720	1800	2800	2420
MIN							2350	1390	1140	1130	1040	1180

04096400 ST. JOSEPH RIVER NEAR BURLINGTON, MI

LOCATION.--Lat 42°06'10", long 85°02'25", in SW1/4 SW1/4 sec.20, T.4 S., R.6 W., Calhoun County, Hydrologic Unit 04050001, on right bank 10 ft upstream from bridge on 13 Mile Road, 2.0 mi east of Burlington, 4.0 mi downstream from Tekonsha Creek, and at mile 164.

DRAINAGE AREA.--201 mi².

PERIOD OF RECORD.--October 1962 to current year.

GAGE.--Water-stage recorder. Datum of gage is 916.21 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 18, Jan. 25-29, Feb. 3-14, 18, 21, 22, June 28 to July 17, and July 28 to Aug. 18. Records good except for periods with ice effect, Dec. 30 to Jan. 18, Jan. 25-29, Feb. 3-14, 18, 21, and 22, which are poor and periods of no gage-height record, June 28 to July 17 and July 28 to Aug. 18, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 172 ft³/s, 11.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,340 ft³/s, Mar. 21, 1982, gage height, 5.78 ft; minimum, 8.0 ft³/s, Aug. 9, 10, 11, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 536 ft³/s, Apr. 7, gage height, 4.37 ft; minimum daily, 13 ft³/s, July 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	68	103	159	215	375	225	272	198	92	23	21	30
2	64	103	157	200	372	228	273	190	90	22	20	29
3	60	100	153	190	330	236	276	182	91	21	18	31
4	56	97	152	175	300	229	281	176	88	21	17	50
5	54	92	149	160	280	221	277	169	83	20	18	62
6	53	86	141	150	260	217	319	163	79	19	19	61
7	53	82	135	145	240	217	508	153	75	18	19	55
8	51	80	149	145	225	223	494	149	70	16	20	49
9	50	78	176	145	225	244	470	150	66	14	21	44
10	49	77	193	145	225	251	470	153	62	13	22	40
11	50	74	200	145	225	245	463	152	60	15	22	37
12	50	74	215	145	225	250	454	147	58	17	23	36
13	48	73	218	145	225	259	436	140	56	19	23	38
14	50	72	216	145	225	253	409	132	53	21	24	37
15	49	71	262	145	234	244	373	135	49	22	25	37
16	48	69	331	145	245	235	339	149	50	24	26	34
17	47	69	326	170	249	225	313	145	49	26	27	33
18	46	71	318	230	250	219	293	140	46	29	29	36
19	49	72	316	256	249	212	272	134	43	32	44	54
20	54	71	371	276	238	205	259	137	41	32	47	88
21	63	69	416	292	220	197	251	134	40	31	44	90
22	69	67	394	293	210	192	245	128	36	30	39	97
23	74	67	381	265	259	189	246	126	37	29	41	155
24	84	67	375	251	250	199	240	147	33	32	41	168
25	102	88	383	220	241	225	236	139	33	33	41	147
26	106	123	376	180	236	246	230	130	30	32	38	124
27	120	144	359	160	238	247	224	120	29	30	35	106
28	119	146	347	160	230	246	218	112	27	27	39	95
29	120	151	321	180	226	261	211	107	26	25	36	87
30	115	157	260	232	---	282	205	105	25	24	35	80
31	107	---	240	312	---	284	---	98	---	22	32	---
TOTAL	2128	2693	8189	6017	7307	7206	9557	4440	1617	739	906	2030
MEAN	68.6	89.8	264	194	252	232	319	143	53.9	23.8	29.2	67.7
MAX	120	157	416	312	375	284	508	198	92	33	47	168
MIN	46	67	135	145	210	189	205	98	25	13	17	29
CFSM	.34	.45	1.31	.97	1.25	1.15	1.59	.71	.27	.12	.15	.34
IN.	.39	.50	1.52	1.11	1.35	1.33	1.77	.82	.30	.14	.17	.38

CAL YR 1987 TOTAL 44716 MEAN 123 MAX 416 MIN 25 CFSM .61 IN 8.28
WTR YR 1988 TOTAL 52829 MEAN 144 MAX 508 MIN 13 CFSM .72 IN 9.78

04096515 SOUTH BRANCH HOG CREEK NEAR ALLEN, MI
(Formerly published as Hog Creek near Allen)

LOCATION.--Lat 41°56'55", long 84°49'40", in NE1/4 SE1/4 sec.13, T.6 S., R.5 W., Branch County, Hydrologic Unit C4050001, on left bank 12 ft downstream from bridge on U.S. Highway 12, 1.0 mi downstream from Little Hog Creek, and 3.1 mi west of Allen.

DRAINAGE AREA.--48.7 mi².

PERIOD OF RECORD.--October 1969 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,010 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to May 23, 1970, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 28 to Jan. 20, Jan. 25-30, and Feb. 3-17, 21, 22. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--19 years, 42.1 ft³/s, 11.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 664 ft³/s, Feb. 25, 1985, gage height, 6.0 ft, from floodmarks; minimum, 0.48 ft³/s, Aug. 5, 1988; minimum gage height, 1.20 ft, July 16, Aug. 5, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 176 ft³/s, Apr. 8, gage height, 4.04 ft; minimum, 0.48 ft³/s, Aug. 5; minimum gage height, 1.20 ft, July 16, Aug. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.3	10	31	43	108	48	78	36	9.3	1.5	1.5	1.9
2	5.4	10	30	35	121	49	76	33	8.9	1.5	.98	1.7
3	5.2	9.5	27	30	100	55	75	31	9.8	1.1	.64	3.4
4	4.4	9.1	27	25	80	49	82	29	8.5	.89	.58	6.5
5	3.8	8.7	25	20	60	43	84	27	7.8	.90	.58	6.2
6	3.7	8.0	23	17	50	42	91	25	7.1	.87	.93	5.2
7	3.9	7.6	22	16	40	44	136	23	6.3	.83	1.3	4.4
8	3.6	7.6	33	16	36	47	173	22	5.7	.79	1.0	4.0
9	3.2	7.8	51	16	33	59	167	23	5.4	.79	.76	3.8
10	3.2	7.2	55	16	31	58	146	29	5.0	1.0	.89	3.4
11	4.1	6.7	50	16	30	54	125	26	4.5	1.8	1.7	3.1
12	4.0	6.4	50	16	30	55	105	24	4.1	1.5	2.3	3.0
13	3.6	6.6	46	16	30	61	93	23	3.8	1.2	1.7	3.2
14	3.5	6.2	41	16	30	57	84	21	3.7	1.1	1.0	3.2
15	3.2	6.2	56	16	33	53	76	22	3.4	.86	2.0	2.8
16	3.3	6.2	83	16	36	49	68	37	3.0	.80	2.2	2.6
17	3.2	6.6	87	20	40	46	60	29	2.9	1.5	1.8	2.5
18	3.7	8.3	82	50	45	46	57	24	2.7	1.6	1.6	2.9
19	3.9	7.5	75	70	46	46	51	22	2.6	1.8	2.7	4.8
20	4.4	7.3	88	85	48	44	46	20	2.4	1.9	3.2	9.4
21	5.8	7.2	113	91	44	42	45	19	2.2	2.0	2.8	8.6
22	7.2	6.4	121	75	42	40	43	18	2.1	2.0	2.3	7.9
23	7.7	6.5	115	64	62	41	43	17	2.1	3.9	2.6	9.8
24	9.1	6.8	103	51	67	50	42	21	2.1	2.8	3.2	9.1
25	13	23	100	38	61	70	39	18	1.8	2.5	2.6	7.3
26	10	40	96	31	55	84	36	16	1.6	2.3	2.2	6.5
27	16	30	89	27	53	85	37	14	1.6	1.9	2.1	5.4
28	16	25	77	25	48	79	44	13	1.8	1.8	2.7	4.7
29	12	29	69	27	47	78	42	12	1.7	1.4	2.8	4.3
30	11	32	60	34	---	81	38	11	1.6	1.5	2.6	4.1
31	9.9	---	50	84	---	82	---	10	---	1.8	2.3	---
TOTAL	197.3	359.7	1975	1102	1506	1737	2282	695	125.5	48.13	57.66	145.7
MEAN	6.36	12.0	63.7	35.5	51.9	56.0	76.1	22.4	4.18	1.55	1.86	4.86
MAX	16	40	121	91	121	85	173	37	9.8	3.9	3.2	9.8
MIN	3.2	6.2	22	16	30	40	36	10	1.6	.79	.58	1.7
CFSM	.13	.25	1.31	.73	1.07	1.15	1.56	.46	.09	.03	.04	.10
IN.	.15	.27	1.51	.84	1.15	1.33	1.74	.53	.10	.04	.04	.11

CAL YR 1987 TOTAL 8763.10 MEAN 24.0 MAX 121 MIN 2.1 CFSM .49 IN 6.69
WTR YR 1988 TOTAL 10230.99 MEAN 28.0 MAX 173 MIN .58 CFSM .58 IN 7.81

04096600 COLDWATER RIVER NEAR HODUNK, MI

LOCATION.--Lat 42°01'45", long 85°06'25", in NW1/4 NE1/4 sec.22, T.5 S., R.7 W., Branch County, Hydrologic Unit 04050001, on downstream side of bridge on Girard Road, 2.5 mi northwest of Hodunk, and 3.5 mi upstream from mouth.

DRAINAGE AREA.--293 mi².

PERIOD OF RECORD.--October 1962 to current year.

REVISED RECORDS.--WDR MI-76-1: 1974.

GAGE.--Water-stage recorder. Elevation of gage is 900 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to July 26, 1963, nonrecording gage and crest-stage gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 2-17. Records good except for estimated daily discharges, Jan. 2-5, which are fair and estimated daily discharges, Jan. 6-17, which are poor. Diurnal fluctuation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 252 ft³/s, 11.68 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,280 ft³/s, Feb. 26, 1985, gage height, 8.40 ft; minimum, 6.2 ft³/s, Sept. 26, 1964; minimum gage height, 2.28 ft, Oct. 4-14, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,060 ft³/s, Apr. 8, gage height, 6.16 ft; minimum, 13 ft³/s, July 8, 9, 10, gage height, 2.39 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	98	165	161	489	513	344	406	261	91	24	20	27
2	93	165	169	450	564	356	398	253	59	23	18	26
3	88	163	167	420	550	358	398	246	63	21	18	33
4	85	160	164	380	506	347	399	235	65	21	16	54
5	82	152	162	360	464	329	402	225	65	19	18	53
6	69	149	159	330	431	315	453	218	64	18	22	49
7	38	145	159	310	407	308	685	212	65	17	20	45
8	36	142	171	290	392	308	1020	207	64	16	19	42
9	36	137	206	270	370	322	943	179	61	14	19	39
10	35	135	234	250	356	333	851	122	60	16	19	36
11	35	133	241	230	333	327	775	122	60	22	23	35
12	35	131	245	215	318	322	700	120	61	22	23	35
13	35	129	246	190	312	325	632	107	60	21	23	35
14	36	126	238	175	300	325	578	90	57	20	22	34
15	37	124	360	160	333	315	536	88	54	18	27	32
16	37	121	555	150	351	303	500	94	52	19	28	30
17	36	121	608	185	352	296	473	104	53	27	27	30
18	36	119	562	287	351	289	449	107	50	27	26	31
19	42	118	527	326	355	286	429	106	47	34	38	48
20	86	115	586	355	353	284	412	111	46	35	38	102
21	121	111	684	365	321	278	331	115	43	35	34	125
22	189	110	720	344	343	274	259	116	41	38	32	120
23	181	108	665	320	388	266	266	120	39	34	35	132
24	177	105	630	301	397	275	266	186	37	34	35	127
25	177	111	609	285	377	313	265	243	33	35	34	112
26	174	124	598	243	348	357	261	223	29	33	31	103
27	177	140	568	255	362	364	261	204	27	32	29	97
28	178	138	564	262	348	362	263	187	27	28	33	90
29	178	141	591	262	337	368	267	172	28	24	31	86
30	171	151	536	280	---	397	267	163	25	24	30	63
31	166	---	501	407	---	418	---	133	---	22	29	---
TOTAL	2964	3989	12586	9146	11132	10064	14145	5069	1526	775	817	1871
MEAN	95.5	133	406	295	384	325	472	164	50.9	25.0	26.4	62.4
MAX	189	165	720	489	564	418	1020	261	91	38	38	132
MIN	35	105	159	150	300	266	259	88	25	14	16	26
CFSM	.33	.45	1.39	1.01	1.31	1.11	1.61	.56	.17	.09	.09	.21
IN.	.38	.51	1.60	1.16	1.41	1.28	1.80	.64	.19	.10	.10	.24

CAL YR 1987 TOTAL 58479 MEAN 160 MAX 720 MIN 23 CFSM .55 IN 7.42
WTR YR 1988 TOTAL 74084 MEAN 202 MAX 1020 MIN 14 CFSM .69 IN 9.41

04096900 NOTTAWA CREEK NEAR ATHENS, MI

LOCATION.--Lat 42°03'20", long 85°18'30", in NW1/4 sec.12, T.5 S., R.9 W., St. Joseph County, Hydrologic Unit 04050001, on right bank at downstream side of bridge on Shorts Road, 4.2 mi southwest of Athens, and 5.0 mi downstream from Pine Creek.

DRAINAGE AREA.--162 mi^2.

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 18, Jan. 26-29, and Feb. 5-15. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 148 ft^3/s, 12.41 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,340 ft^3/s, Feb. 26, 1985, gage height, 6.03 ft; maximum gage height, 6.47 ft, June 29, 1978; minimum discharge, 21 ft^3/s, July 28, 29, 30, Aug. 4, 6, 1977, Aug. 4, 1988; minimum gage height, 0.37 ft, Oct. 16, 18, 20, 21, Nov. 8, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 598 ft^3/s, Apr. 8, gage height, 3.79 ft; minimum, 21 ft^3/s, Aug. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	108	98	165	150	363	205	263	158	94	41	39	36
2	102	100	159	140	418	213	246	148	95	39	32	37
3	87	101	151	130	399	221	242	142	98	39	25	42
4	76	96	140	120	345	208	260	137	96	36	21	58
5	70	91	130	118	280	195	264	134	93	36	28	71
6	67	85	122	115	235	181	289	131	91	36	57	78
7	67	82	116	115	215	181	450	128	89	35	69	77
8	67	82	130	115	200	188	584	125	86	35	60	64
9	65	81	173	115	180	209	568	126	81	36	49	51
10	63	81	203	115	170	221	495	133	80	37	48	44
11	65	78	207	115	165	216	414	133	79	39	47	40
12	66	77	201	115	165	205	341	129	76	36	44	39
13	63	77	194	115	165	208	288	126	73	33	41	41
14	62	77	179	115	165	208	252	122	70	32	39	38
15	61	75	205	115	190	196	228	119	67	32	47	35
16	60	73	291	115	205	183	212	123	63	36	54	35
17	59	73	339	150	208	174	199	126	58	46	50	34
18	61	74	339	230	209	171	196	122	57	50	46	38
19	61	73	319	292	209	171	191	118	55	50	53	66
20	66	73	334	308	206	168	186	115	56	50	55	104
21	84	69	395	336	196	162	180	114	58	56	51	118
22	102	68	415	324	186	157	176	113	55	54	46	130
23	112	70	392	281	209	156	186	111	57	52	49	156
24	116	73	357	234	223	166	198	118	58	54	52	198
25	119	90	330	202	205	187	197	121	54	57	49	223
26	123	36	307	185	195	209	186	112	48	59	45	222
27	121	157	278	175	204	209	176	107	42	53	42	203
28	129	152	252	170	203	196	175	104	41	46	45	173
29	126	148	214	160	199	197	174	101	42	41	45	140
30	114	159	190	169	---	230	167	99	42	38	41	110
31	104	1--	170	252	---	264	---	97	---	38	37	---
TOTAL	2646	69	7397	5391	6512	6055	7983	3792	2054	1322	1406	2701
MEAN	85.4	27.3	239	174	225	195	266	122	68.5	42.6	45.4	90.0
MAX	129	9259	415	336	418	264	584	158	98	59	69	223
MIN	59	168	116	115	165	156	167	97	41	32	21	34
CFSM	.53	57	1.48	1.07	1.39	1.20	1.64	.75	.42	.26	.28	.56
IN.	.61	.64	1.70	1.24	1.50	1.39	1.83	.87	.47	.30	.32	.62

CAL YR 1987 TOTAL 43307 MEAN 119 MAX 415 MIN 35 CFSM .74 IN 9.94
WTR YR 1988 TOTAL 50028 MEAN 137 MAX 584 MIN 21 CFSM .85 IN 11.49

04097195 GOURDNECK CANAL NEAR SCHOOLCRAFT, MI

LOCATION.--Lat 42°09'54", long 85°36'15", in NW1/4 sec.33, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050001, on right bank at downstream end of culvert on Osterhout Avenue, 3.8 mi northeast of Schoolcraft.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--October 1965 to December 1972, October 1982 to current year.

GAGE.--Water-stage recorder. Metal V-notch weir Aug. 4, 1969, to Dec. 31, 1972. Datum of gage is 854.98 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--No estimated daily discharges. Records poor. Canal diverts water from Gourdneck Creek to West Lake to sustain lake levels. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--13 years, 2.58 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16 ft³/s, Dec. 10-12, 1966, Apr. 22-24, 1967; no flow on many days during November, December, 1970, January, February, 1971.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.64	.38	.19	.10	.44	.22	.54	1.1	.39	.19	.31	1.8
2	.63	.39	.16	.09	.47	.25	.56	1.8	.38	.17	.31	1.8
3	.56	.43	.13	.08	.44	.28	.70	1.8	.37	.17	.28	1.8
4	.51	.44	.12	.07	.43	.26	.82	1.8	.34	.16	.24	1.8
5	.54	.41	.12	.06	.38	.25	.78	1.8	.35	.16	.24	1.9
6	.56	.35	.12	.06	.34	.27	1.1	1.7	.35	.16	.23	1.9
7	.52	.33	.13	.05	.30	.31	1.3	1.7	.35	.14	.23	1.9
8	.50	.35	.15	.05	.27	.35	1.1	1.7	.33	.14	.26	1.8
9	.52	.35	.17	.05	.25	.41	1.1	1.7	.30	.14	.28	1.8
10	.55	.31	.14	.05	.22	.48	1.0	1.6	.30	.14	.25	1.8
11	.56	.27	.14	.06	.19	.55	1.0	1.6	.28	.13	.25	1.8
12	.55	.25	.12	.05	.19	.63	1.0	1.5	.28	.14	.26	1.8
13	.56	.23	.07	.05	.18	.51	.97	1.5	.26	.14	.26	1.8
14	.54	.26	.06	.04	.17	.44	.93	1.4	.26	.14	.24	1.8
15	.53	.26	.15	.05	.30	.43	.94	1.4	.26	.15	1.8	1.8
16	.56	.26	.12	.05	.30	.43	.84	1.4	.27	.24	1.8	1.8
17	.55	.29	.08	.13	.26	.41	.94	1.4	.26	.29	1.8	1.8
18	.46	.26	.06	.15	.25	.43	.70	1.4	.26	.26	1.8	1.9
19	.44	.21	.09	.13	.24	.39	.93	1.4	.26	.23	1.8	2.1
20	.45	.15	.32	.20	.23	.40	.99	1.2	.28	.33	1.8	2.1
21	.43	.13	.33	.21	.21	.40	.89	.45	.27	.36	1.8	2.1
22	.35	.13	.27	.17	.21	.40	.86	.39	.24	.39	1.8	2.0
23	.31	.17	.22	.17	.21	.43	.80	.39	.25	.37	1.9	2.2
24	.34	.17	.22	.17	.18	.63	.63	.39	.23	.35	1.9	2.1
25	.32	.26	.24	.14	.17	.54	.76	.36	.22	.42	1.9	2.1
26	.34	.20	.21	.13	.15	.61	.77	.37	.19	.40	1.8	2.0
27	.36	.17	.18	.11	.17	.51	.83	.43	.22	.39	1.8	2.0
28	.34	.18	.18	.10	.18	.59	.82	.42	.23	.39	1.9	1.9
29	.32	.23	.18	.09	.19	.57	.85	.40	.21	.36	1.8	1.9
30	.32	.21	.14	.13	---	.64	.91	.39	.21	.35	1.8	1.9
31	.35	---	.12	.28	---	.59	---	.39	---	.32	1.8	---
TOTAL	14.51	8.03	4.93	3.27	7.52	13.61	26.36	35.28	8.40	7.72	34.64	57.2
MEAN	.47	.27	.16	.11	.26	.44	.88	1.14	.28	.25	1.12	1.91
MAX	.64	.44	.33	.28	.47	.64	1.3	1.8	.39	.42	1.9	2.2
MIN	.31	.13	.06	.04	.15	.22	.54	.36	.19	.13	.23	1.8

CAL YR 1987 TOTAL 174.75 MEAN .48 MAX 1.1 MIN .06
WTR YR 1988 TOTAL 221.47 MEAN .61 MAX 2.2 MIN .04

04097540 PRAIRIE RIVER NEAR NOTTAWA, MI

LOCATION.--Lat 41°53'18", long 85°24'34", in NW1/4 SW1/4 sec.6, T.7 S., R.9 W., St. Joseph County, Hydrologic Unit 04050001, on left bank 10 ft upstream from bridge on State Highway 66, 3.0 mi upstream from unnamed tributary, and 3.0 mi southeast of Nottawa.

DRAINAGE AREA.--106 mi².

PERIOD OF RECORD.--October 1962 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Jan. 2-15, 26-28, and Feb. 6-14. Records good except for estimated daily discharges, which are fair. Since 1987, some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 94.2 ft³/s, 12.07 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 797 ft³/s, Feb. 26, 1985, gage height, 6.30 ft; minimum, 5.4 ft³/s, Aug. 4, 5, 1988, gage height, 1.57 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 197 ft³/s, Apr. 9, gage height, 4.28 ft; maximum gage height, 4.83 ft, Jan. 2, backwater from ice; minimum discharge, 5.4 ft³/s, Aug. 4, 5, gage height, 1.57 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	46	45	77	139	152	111	139	93	54	13	9.3	21
2	44	45	77	130	166	111	137	89	54	12	9.8	21
3	42	45	76	120	166	111	134	86	54	13	7.8	22
4	40	45	77	110	159	110	133	84	53	11	6.2	30
5	37	44	75	105	150	106	130	82	52	10	5.7	32
6	36	42	74	100	130	103	139	78	50	10	7.6	32
7	37	42	74	98	120	100	172	75	48	9.7	9.4	30
8	36	42	79	96	105	100	191	72	46	7.8	11	28
9	35	41	89	95	100	104	197	76	45	7.8	11	26
10	35	40	96	95	100	106	194	76	41	9.4	10	24
11	36	39	100	95	100	105	181	73	41	13	11	23
12	35	39	102	95	100	105	166	72	40	16	13	22
13	34	39	101	95	100	106	155	68	39	17	14	22
14	32	38	98	96	105	105	146	67	37	16	15	22
15	31	36	117	96	114	104	137	65	35	13	21	21
16	30	36	149	96	125	101	129	67	32	13	23	20
17	32	36	164	97	124	98	125	65	30	15	24	20
18	32	36	165	118	121	96	123	64	29	15	23	22
19	32	37	161	126	119	93	119	63	28	16	25	33
20	35	37	172	128	120	93	116	62	28	18	24	50
21	38	37	185	125	122	92	114	58	29	20	24	56
22	39	37	192	121	115	90	112	57	28	18	22	55
23	40	37	191	115	120	89	109	58	25	18	23	53
24	42	38	186	109	129	94	105	76	23	18	23	48
25	45	49	180	105	128	107	102	83	21	17	23	44
26	46	62	172	100	122	118	99	82	20	16	21	39
27	48	68	165	90	118	124	99	76	17	13	20	36
28	49	69	162	85	115	124	99	71	16	10	22	34
29	49	72	158	93	112	126	99	65	18	9.3	23	32
30	47	76	150	101	---	134	97	62	14	8.9	24	31
31	46	---	144	126	---	139	---	58	---	9.2	22	---
TOTAL	1206	1348	4008	3300	3557	3305	3998	2223	1047	413.1	527.8	949
MEAN	38.9	44.9	129	106	123	107	133	71.7	34.9	13.3	17.0	31.6
MAX	49	76	192	139	166	139	197	93	54	20	25	56
MIN	30	36	74	85	100	89	97	57	14	7.8	5.7	20
CFSM	.37	.42	1.22	1.00	1.16	1.01	1.26	.68	.33	.13	.16	.30
IN.	.42	.47	1.41	1.16	1.25	1.16	1.40	.78	.37	.14	.19	.33

CAL YR 1987 TOTAL 25547.0 MEAN 70.0 MAX 192 MIN 23 CFSM .66 IN 8.97
WTR YR 1988 TOTAL 25881.9 MEAN 70.7 MAX 197 MIN 5.7 CFSM .67 IN 9.08

04099000 ST. JOSEPH RIVER AT MOTTVILLE, MI

LOCATION.--Lat 41°48'03", long 85°45'22", in SW1/4 sec.6, T.8 S., R.12 W., Michigan Meridian, St. Joseph County, Hydrologic Unit 04050001, on right bank 500 ft upstream from bridge on U.S. Highway 12 at Mottville, 0.4 mi downstream from Michigan Power Co. hydroelectric plant, 4 mi upstream from Pigeon River, and at mile 96.

DRAINAGE AREA.--1,866 mi^2.

PERIOD OF RECORD.--October 1923 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1930, 1932, 1938, 1940-42, 1945. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 755.3 ft, Michigan Power Co. datum. Prior to Oct. 1, 1951, at site 0.4 mi upstream at datum 4.2 ft higher.

REMARKS.--Estimated daily discharges: Jan. 5-11, 27-29, and Feb. 6, 7, 12-14. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--65 years, 1,600 ft^3/s, 11.64 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,700 ft^3/s, Apr. 27, 1950, gage height, 10.76 ft, present datum; minimum daily, 39 ft^3/s, Oct. 19, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,200 ft^3/s, Apr. 9, gage height, 5.91 ft; minimum daily, 222 ft^3/s, July 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEL	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	791	1170	1680	2730	2680	2220	2730	1960	1180	406	401	553
2	1240	1400	1690	2250	2930	2220	2590	1810	1130	358	397	537
3	1060	1280	1720	1980	3260	2210	2620	1750	1110	358	394	655
4	772	1120	1710	2240	3130	2280	2640	1760	1050	358	393	599
5	1070	1170	1670	1800	2950	2260	2630	1650	821	358	391	575
6	1110	1140	1390	1650	2400	2210	2870	1650	652	350	388	689
7	972	1080	1520	1750	2150	2090	3130	1740	884	326	375	736
8	1040	1010	1690	1800	2210	2000	3460	1540	779	305	363	633
9	1070	996	1690	1850	2340	1960	4000	1390	699	245	365	628
10	990	1230	1800	1900	2410	2140	4160	1480	618	222	375	683
11	714	1020	1740	1900	2370	2200	3980	1570	528	254	388	554
12	1020	1060	1710	1940	2150	2180	3780	1530	557	284	395	534
13	916	1040	1780	1880	2100	2050	2900	1470	568	337	405	628
14	679	1020	1910	1780	2100	2110	3460	1430	614	365	407	664
15	772	1020	1970	1740	2230	2120	2980	1330	699	364	421	599
16	842	878	2440	1740	2310	2160	2910	1130	687	375	567	587
17	885	1270	2430	1720	2380	2050	2790	1250	693	506	623	702
18	751	1250	2640	1860	2420	2040	2490	1410	671	495	555	598
19	861	1050	2750	2240	2430	2030	2640	1370	663	514	573	558
20	974	798	3010	2450	2440	1980	2470	1330	566	538	627	1180
21	838	698	3110	2520	2380	1930	2320	1160	493	541	537	1250
22	837	934	3360	2590	2280	1910	2280	848	529	511	532	1160
23	1110	952	3370	2580	2260	1900	2270	1410	502	464	576	1130
24	1050	1110	3370	2450	2270	1900	2220	1520	520	449	618	1160
25	1050	1100	3350	2370	2390	1930	1970	1220	530	527	563	1190
26	1330	1130	3310	1960	2380	1960	1790	1250	503	553	524	1600
27	1200	1210	3270	1800	2360	2140	1990	1220	467	515	522	1220
28	1210	1560	2920	1800	2340	2250	2070	1260	448	487	511	1220
29	1350	1620	2780	1850	2230	2320	2020	1280	429	448	510	1140
30	1370	1430	2790	2170	---	2360	1990	1250	421	406	530	905
31	1180	---	2750	2260	---	2690	---	1230	---	401	535	---
TOTAL	31054	33746	73320	63550	70280	65800	82150	44198	20011	12620	14761	24867
MEAN	1002	1125	2365	2050	2423	2123	2738	1426	667	407	476	829
MAX	1370	1620	3370	2730	3260	2690	4160	1960	1180	553	627	1600
MIN	679	698	1390	1650	2100	1900	1790	848	421	222	363	534
CFSM	.54	.60	1.27	1.10	1.30	1.14	1.47	.76	.36	.22	.26	.44
IN.	.62	.67	1.46	1.27	1.40	1.31	1.64	.88	.40	.25	.29	.50

CAL YR 1987 TOTAL 504016 MEAN 1381 MAX 3370 MIN 369 CFSM .74 IN 10.05
WTR YR 1988 TOTAL 536357 MEAN 1465 MAX 4160 MIN 222 CFSM .79 IN 10.69

04099750 PIGEON RIVER NEAR SCOTT, IN

LOCATION.--Lat 41°44'56", long 85°34'35", in SE1/4 NW1/4 sec.14, T.38 N., R.8 E., Lagrange County, Hydrologic Unit 04050001, on right bank 20 ft downstream from bridge on County Road 750 North, 1,200 ft downstream from Page Ditch, 0.7 mi south of Indiana-Michigan State line, and 1.2 mi northwest of Scott, IN.

DRAINAGE AREA.--361 mi^2, of which 53.9 mi^2 does not contribute directly to surface runoff.

PERIOD OF RECORD.--June 1968 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 815.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Jan. 1-17, 25-28, and Feb. 5-16. Records good except for estimated daily discharges, which are poor.

AVERAGE DISCHARGE.--20 years, 365 ft^3/s, 13.73 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,370 ft^3/s, Mar. 21, 1982, gage height, 7.85 ft; minimum daily, 42 ft^3/s, Oct. 21, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 994 ft^3/s, Dec. 21, gage height, 5.08 ft; maximum gage height, 6.12 ft, Feb. 7, backwater from ice; minimum daily discharge, 68 ft^3/s, July 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	172	170	378	600	595	455	697	290	191	86	91	81
2	153	169	377	550	618	435	673	281	189	87	85	79
3	149	169	376	500	594	425	665	274	188	86	80	181
4	144	168	390	470	578	401	645	268	181	84	74	289
5	141	164	379	440	550	380	616	260	173	76	82	237
6	144	158	365	410	530	366	642	253	170	75	100	181
7	145	156	357	390	500	357	843	246	161	72	104	141
8	142	162	380	370	470	357	877	241	152	71	94	126
9	145	162	425	350	420	367	803	245	147	68	84	123
10	151	157	435	330	400	363	768	242	144	84	83	119
11	153	153	426	315	370	349	747	237	141	105	10[illegible]	117
12	150	150	452	300	360	353	714	232	137	101	101	122
13	143	148	459	290	350	365	656	228	133	94	85	127
14	137	146	447	285	400	357	601	222	126	102	80	122
15	137	144	582	280	560	349	560	220	120	119	107	116
16	137	143	843	280	600	343	526	268	123	142	118	114
17	134	145	787	350	557	335	499	246	123	150	100	113
18	135	146	734	557	444	330	475	226	120	137	91	113
19	135	152	735	526	440	324	436	215	120	134	100	139
20	141	152	836	472	456	321	409	213	117	126	99	279
21	150	150	971	463	437	314	405	211	117	126	92	239
22	148	146	948	454	428	295	385	204	114	117	91	193
23	146	148	892	453	512	300	369	209	112	116	94	175
24	152	150	873	445	523	342	350	321	103	126	99	154
25	168	237	877	390	511	498	336	293	98	119	87	144
26	161	379	860	330	508	553	323	254	95	115	7[illegible]	136
27	174	335	807	310	510	555	321	238	92	109	82	129
28	193	305	775	320	492	585	335	226	89	102	102	126
29	184	333	752	357	470	675	305	218	91	90	99	124
30	177	368	715	366	---	722	300	209	87	92	92	123
31	170	---	654	484	---	745	---	202	---	98	85	---
TOTAL	4711	5665	19287	12437	14183	12916	16281	7492	3954	3209	2867	4462
MEAN	152	189	622	401	489	417	543	242	132	104	92.5	149
MAX	193	379	971	600	618	745	877	321	191	150	118	289
MIN	134	143	357	280	350	295	300	202	87	68	74	79
CFSM	.42	.52	1.72	1.11	1.35	1.15	1.50	.67	.37	.29	.26	.41
IN.	.49	.58	1.99	1.28	1.46	1.33	1.68	.77	.41	.33	.30	.46

CAL YR 1987 TOTAL 100416 MEAN 275 MAX 971 MIN 101 CFSM .76 IN 10.35
WTR YR 1988 TOTAL 107464 MEAN 294 MAX 971 MIN 68 CFSM .81 IN 11.07

04100222 NORTH BRANCH ELKHART RIVER AT COSPERVILLE, IN

LOCATION.--Lat 41°28'54", long 85°28'32", in NE1/4 NW1/4 sec.22, T.35 N., R.9 E., Noble County, Hydrologic Unit 0405000 , on right bank at downstream side of bridge on County Road 900 North at Cosperville, IN, 1,300 ft downstream from Boyd Ditch, 1.7 mi upstream from Hustin Ditch, and 3.1 mi downstream from Waldron Lake.

DRAINAGE AREA.--142 mi².

PERIOD OF RECORD.--October 1971 to current year.

GAGE.--Water-stage recorder. Datum of gage is 880.12 ft above National Geodetic Vertical Datum of 1929 (levels by Indiana Department of Natural Resources).

REMARKS.--Estimated daily discharges: Dec. 31 to Jan. 18, Jan. 25-30, Feb. 5-16, and May 18 to June 1. Records good except for estimated daily discharges, which are poor. Flow regulated at times by dam at Waldron Lake.

AVERAGE DISCHARGE.--17 years, 138 ft³/s, 13.20 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 919 ft³/s, Mar. 23, 1982, gage height, 8.12 ft; minimum daily, 2.2 ft³/s, July 7, 1988, caused by regulation.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 371 ft³/s, Apr. 9, gage height, 5.56 ft; minimum daily, 2.2 ft³/s, July 7, caused by regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	29	52	115	190	168	157	271	114	44	3.6	20	17
2	24	56	116	170	183	151	269	109	42	3.3	15	15
3	23	57	118	150	182	150	267	105	39	3.1	11	21
4	20	56	120	140	177	144	262	102	32	3.1	9.0	45
5	18	54	119	130	160	137	256	99	23	2.9	8.5	59
6	17	53	117	120	150	133	274	94	22	2.7	15	60
7	17	52	118	110	140	129	337	90	22	2.2	14	54
8	16	52	121	102	130	128	366	37	22	2.6	11	48
9	16	52	131	95	125	128	369	41	20	2.8	7.8	42
10	17	51	141	90	120	128	363	49	15	3.6	7.5	37
11	37	49	143	85	110	126	353	56	12	12	11	33
12	75	47	143	80	105	125	337	57	11	12	14	31
13	60	46	142	75	100	125	320	57	11	9.9	16	29
14	47	45	141	72	100	126	303	56	8.9	8.6	14	26
15	39	44	167	69	110	124	285	54	9.3	9.7	20	23
16	34	42	200	66	140	121	266	53	23	16	23	21
17	31	43	215	73	155	119	248	52	27	20	21	18
18	29	43	217	90	158	117	232	51	24	20	23	18
19	28	44	216	114	162	116	215	50	20	23	43	35
20	30	44	247	121	163	116	200	49	19	24	45	80
21	30	44	270	128	157	114	189	49	18	22	39	86
22	32	43	274	127	160	112	180	48	15	21	31	81
23	33	42	269	124	188	108	168	60	15	28	29	73
24	37	42	264	120	195	135	159	88	13	34	30	65
25	41	63	264	110	189	183	150	86	9.8	42	25	58
26	43	84	259	92	180	217	143	80	7.5	40	21	52
27	48	91	248	84	176	231	136	72	5.5	34	19	46
28	51	93	244	80	167	240	130	63	4.4	29	27	43
29	52	100	235	90	161	246	125	59	4.7	25	27	39
30	52	109	222	100	---	262	120	53	4.2	23	23	35
31	51	---	200	136	---	272	---	49	---	25	20	---
TOTAL	1077	1693	5796	3333	4411	4720	7293	2082	543.3	508.1	639.8	1290
MEAN	34.7	56.4	187	108	152	152	243	67.2	18.1	16.4	20.6	43.0
MAX	75	109	274	190	195	272	369	114	44	42	45	86
MIN	16	42	115	66	100	108	120	37	4.2	2.2	7.5	15
CFSM	.24	.40	1.32	.76	1.07	1.07	1.71	.47	.13	.12	.15	.30
IN.	.28	.44	1.52	.87	1.16	1.24	1.91	.55	.14	.13	.17	.34

CAL YR 1987 TOTAL 32198.0 MEAN 88.2 MAX 274 MIN 4.1 CFSM .62 IN 8.43
WTR YR 1988 TOTAL 33386.2 MEAN 91.2 MAX 369 MIN 2.2 CFSM .64 IN 8.75

04100500 ELKHART RIVER AT GOSHEN, IN

LOCATION.--Lat 41°35'36", long 85°50'55", in NE1/4 NE1/4 sec.8, T.36 N., R.6 E., Elkhart County, Hydrologic Unit 04050001, on right bank 20 ft downstream from River Avenue bridge at Goshen, IN, 0.4 mi upstream from Rock Run, and at mile 16.1.

DRAINAGE AREA.--594 mi^2.

PERIOD OF RECORD.--April 1931 to current year.

REVISED RECORDS.--WSP 1337: 1939(M). WSP 1557: 1954. WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 769.43 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 20, 1931, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 29 to Jan. 17, Jan. 24-29, and Feb. 4-16. Records good except for periods of estimated daily discharges, Dec. 29 to Jan. 17 and Feb. 4-16, which are poor. Occasional low-flow regulation at Goshen Dam 3.4 mi upstream.

AVERAGE DISCHARGE.--57 years, 522 ft^3/s, 11.93 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,360 ft^3/s, Feb. 24, 1985; maximum gage height, 11.94 ft, Mar. 14, 1982: minimum daily discharge, 7.0 ft^3/s, Aug. 11, 1964, result of extreme regulation.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,800 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Apr. 7	2000	*3,390	*7.90	No other peak greater than base discharge.			

Minimum daily discharge, 45 ft^3/s, Oct. 16, caused by regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	174	192	519	720	1110	655	1250	497	218	98	139	153
2	177	195	515	660	1120	634	1150	476	209	97	134	147
3	168	196	511	620	956	612	1130	460	206	95	131	152
4	157	197	523	570	780	581	1100	448	197	94	127	188
5	157	194	538	530	690	551	1050	431	187	93	126	250
6	147	189	529	490	620	528	1340	420	176	95	120	261
7	155	187	538	460	570	515	3010	406	165	97	120	241
8	155	193	592	420	530	507	2520	394	158	94	120	225
9	152	198	684	390	470	523	1840	355	153	90	128	206
10	148	198	723	370	440	529	1550	332	149	92	126	189
11	182	195	667	350	410	517	1400	330	142	88	162	176
12	430	192	662	330	390	518	1320	325	133	96	198	171
13	231	190	650	310	380	523	1240	314	132	100	165	165
14	179	185	629	290	400	514	1180	306	126	106	148	158
15	54	182	893	280	600	483	1120	306	118	113	168	150
16	45	181	1280	270	820	467	1050	307	127	119	222	145
17	126	185	1260	450	787	470	1000	283	140	121	189	143
18	151	173	1030	740	824	492	954	271	131	157	186	142
19	149	183	956	794	870	499	897	267	126	170	264	169
20	157	179	1180	734	849	489	860	259	128	176	282	205
21	156	178	1500	774	759	469	838	250	124	176	223	272
22	156	180	1370	678	746	456	796	236	117	168	198	278
23	154	181	1140	635	1000	449	760	239	124	168	197	270
24	167	183	1070	560	943	619	726	339	122	184	200	248
25	177	276	1090	480	795	1120	689	362	113	187	187	230
26	179	410	1120	380	733	1200	656	336	108	177	173	213
27	187	401	1050	320	734	1010	635	311	106	169	167	197
28	193	410	1020	300	711	930	588	286	102	158	183	187
29	196	477	930	450	686	1000	546	263	100	144	182	179
30	192	523	850	691	---	1220	518	246	100	138	172	174
31	191	---	790	921	---	1400	---	231	---	139	162	---
TOTAL	5242	7003	26809	15967	20723	20480	33713	10286	4237	3999	5299	5884
MEAN	169	233	865	515	715	661	1124	332	141	129	171	196
MAX	430	523	1500	921	1120	1400	3010	497	218	187	282	278
MIN	45	173	511	270	380	449	518	231	100	88	120	142
CFSM	.28	.39	1.46	.87	1.20	1.11	1.89	.56	.24	.22	.29	.33
IN.	.33	.44	1.68	1.00	1.30	1.28	2.11	.64	.27	.25	.33	.37

CAL YR 1987 TOTAL 158552 MEAN 434 MAX 1500 MIN 45 CFSM .73 IN 9.93
WTR YR 1988 TOTAL 159642 MEAN 436 MAX 3010 MIN 45 CFSM .73 IN 10.00

04101000 ST. JOSEPH RIVER AT ELKHART, IN

LOCATION.--Lat 41°41'30", long 85°58'30", in SW1/4 NE1/4 sec.5, T.37 N., R.5 E., Elkhart County, Hydrologic Unit 04050001, on left bank 200 ft downstream from Elkhart River, 200 ft upstream from Main Street bridge in Elkhart, IN, 2,000 ft downstream from Christiana Creek, 0.5 mi downstream from Elkhart Hydroelectric Plant, and at mile 76.5.

DRAINAGE AREA.--3,370 mi^2.

PERIOD OF RECORD.--August 1947 to current year. Gage heights at site 0.8 mi downstream at different datum from September 1924 to March 1926 are available in the Indiana District Office.

REVISED RECORDS.--WSP 2111: Drainage area

GAGE.--Water-stage recorder. Datum of gage is 700.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Elkhart Hydroelectric Plant.

AVERAGE DISCHARGE.--41 years, 3,204 ft^3/s, 12.91 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 18,800 ft^3/s, Feb. 27, 1985; maximum gage height, 27.91 ft, Mar. 21, 1982; minimum daily discharge, 336 ft^3/s, Aug. 5, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,010 ft^3/s, Apr. 7, gage height, 22.89 ft; minimum daily, 613 ft^3/s, July 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1520	2000	2940	4690	5230	4240	5690	3490	2030	852	833	1070
2	2100	2220	3060	3940	5670	3750	5190	3370	1950	766	822	907
3	1820	2370	3080	3860	5780	3930	5420	2960	1940	760	779	1250
4	1680	2010	3060	3740	5430	4070	5460	3400	1870	757	786	1370
5	1650	2070	3020	3170	5100	4020	5220	3020	1690	747	880	1410
6	1930	2080	2810	2910	3880	3970	5730	2970	1370	723	867	1590
7	1760	1940	2660	3240	3840	3750	8550	3100	1520	691	814	1480
8	1770	1880	3180	3340	4130	3690	8270	2940	1450	668	814	1380
9	1950	1780	3350	3390	4580	3620	7860	2700	1380	613	1050	1180
10	2040	1890	3450	3480	4470	3760	7740	2620	1320	618	865	1310
11	1600	2230	3270	3490	3850	3870	7280	2800	1170	648	901	1160
12	1740	1640	3160	3450	3690	3870	6920	2750	1160	670	973	1120
13	1800	1980	3190	3360	3460	3840	6140	2640	1190	701	955	1170
14	1350	1820	3260	3200	3870	3740	6030	2570	1170	811	906	1220
15	1440	1810	4010	3000	4570	3740	5990	2570	1280	871	1250	1150
16	1410	1710	4780	3050	4890	3730	5400	2220	1270	991	1160	1100
17	1370	1780	5200	3320	4860	3740	5320	2400	1260	1060	1320	1190
18	1520	2270	4820	4070	4590	3650	4760	2470	1250	1140	1160	1160
19	983	1720	4890	4340	4670	3690	5000	2440	1230	1150	1290	1210
20	1480	1600	5600	4620	4650	3590	4610	2320	1200	1150	1390	1830
21	1480	1380	6160	4800	4490	3500	4490	2170	1050	1180	1240	2010
22	1530	1540	6190	4490	4310	3470	4270	1940	1050	1200	1140	2030
23	1640	1580	6110	4440	4630	3450	4200	1970	1020	1070	1200	1930
24	1860	1830	5890	4270	4710	3680	4110	3000	1010	1020	1240	1890
25	1790	2070	5870	4010	4510	4410	3850	2330	1010	1070	1180	1890
26	1890	2270	5820	3420	4390	4600	3480	2420	959	1150	1090	2020
27	2060	2470	5710	3210	4390	4460	3680	2330	918	1080	1080	2080
28	1930	2580	5480	3360	4380	4530	3790	2220	911	1000	1140	1850
29	2110	3210	5110	3580	4320	4910	3690	2240	898	949	1100	1790
30	2260	2880	5000	4300	---	5190	3550	2170	842	871	1100	1610
31	2100	---	4990	4740	---	5740	---	2140	---	850	1090	---
TOTAL	53563	60610	135120	116280	131340	124200	161690	80680	38408	27827	32415	44357
MEAN	1728	2020	4359	3751	4529	4006	5390	2603	1280	898	1046	1479
MAX	2260	3210	6190	4800	5780	5740	8550	3490	2030	1200	1390	2080
MIN	983	1380	2660	2910	3460	3450	3480	1940	842	613	779	907
CFSM	.51	.60	1.29	1.11	1.34	1.19	1.60	.77	.38	.27	.31	.44
IN.	.59	.67	1.49	1.28	1.45	1.37	1.78	.89	.42	.31	.36	.49

CAL YR 1987 TOTAL 946543 MEAN 2593 MAX 6190 MIN 983 CFSM .77 IN 10.45
WTR YR 1988 TOTAL 1006490 MEAN 2750 MAX 8550 MIN 613 CFSM .82 IN 11.11

04101500 ST. JOSEPH RIVER AT NILES, MI
(National stream quality accounting network station)

LOCATION.--Lat 41°49'45", long 86°15'35", in SW1/4 sec.26, T.7 S., R.17 W., Berrien County, Hydrologic Unit 04050001, on right bank 100 ft upstream from Main Street Bridge in Niles, 0.6 mi downstream from dam at French Paper Co., 1.3 mi upstream from Dowagiac River, and at mile 44.

DRAINAGE AREA.--3,666 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1931, 1933-36, 1940-43, 1945-46(M). WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 633.02 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, at datum 2.00 ft higher. Oct. 1, 1930 to Feb. 11, 1931, nonrecording gage on Main Street Bridge, and Feb. 12 to June 30, 1931, nonrecording gage 50 ft upstream from present site (gage heights referred to NGVD). Since Apr. 13, 1970, auxiliary water-stage recorder at sewage-treatment plant, 1.1 mi downstream from base gage at same datum. Oct. 1, 1943 to Apr. 12, 1970, auxiliary gage was headwater gage at hydroelectric plant at Buchanan Dam, 8 mi downstream from base gage at different datum.

REMARKS.--Estimated daily discharges: Jan. 5-11. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated by powerplants upstream from station.

AVERAGE DISCHARGE.--58 years, 3,302 ft³/s, 12.23 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,200 ft³/s, Apr. 5, 1950, gage height, 15.10 ft, present datum; minimum daily, 420 ft³/s, Aug. 30, 1931.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 11,100 ft³/s, Apr. 7, gage height, 10.64 ft; minimum daily, 843 ft³/s, July 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2110	2110	3130	5130	5830	4440	6480	3810	2570	1150	1080	1320
2	1630	2040	3510	4830	6300	4270	5790	3710	2370	1010	1000	1280
3	2170	2150	3300	4050	6250	3900	5390	3430	2260	996	1010	1360
4	1890	2280	3460	4430	6190	4220	5960	3180	2350	951	1050	1660
5	1660	1930	3310	3500	5470	4250	5810	3530	2160	934	1060	1590
6	1910	2060	3230	3200	4190	4190	6140	3080	1820	970	1840	1640
7	2050	2130	2980	3500	3930	3950	9290	3050	1620	963	934	1780
8	1910	1930	3120	3600	4360	3990	9790	3200	1830	966	848	1700
9	2130	1880	3730	3700	4870	3910	8890	3030	1740	965	1620	1530
10	2960	1850	3920	3800	4920	3880	8060	2780	1590	954	1270	1430
11	2180	1960	3840	3800	4670	3980	7560	2870	1450	948	1210	1480
12	2040	2030	3580	3830	3470	3920	7490	3010	1420	954	1170	1450
13	2070	1890	3440	3690	3980	3980	6980	3130	1560	948	1090	1410
14	1920	1950	3500	3560	3500	4050	5770	2980	1350	843	1210	1450
15	1530	1930	4110	3210	4650	4090	6540	2760	1310	1310	1220	1440
16	1610	1900	5380	3410	5230	3880	5790	2790	1540	1080	1460	1410
17	1640	2340	6230	3450	5380	3690	5710	2680	1560	1110	1440	1330
18	1680	1650	5770	4400	5430	3910	5380	2910	1330	1300	1650	1370
19	1630	2620	5300	4630	4640	3970	4740	2830	1440	1270	1660	1390
20	1530	2050	5950	4970	5180	3950	5220	2830	1510	1420	1610	1970
21	1200	1600	7180	5330	4840	3750	4820	2750	1470	1350	1580	2340
22	1390	1620	6630	4910	4840	3560	4510	2510	1350	1300	1370	2270
23	1770	1880	6570	4930	4960	3620	4570	2030	1320	1460	1330	2160
24	2070	1910	6520	4450	5330	3950	4530	3430	1290	1280	1360	2080
25	2040	1850	6410	4480	4450	4880	4380	3120	1330	1250	1330	2020
26	2010	2260	6400	3470	4860	5420	3830	2650	1330	1180	1370	2120
27	2270	2570	6270	3380	4520	4660	3740	2920	1180	1240	1290	2270
28	2420	2680	5950	3260	4570	4940	4190	2760	1240	1240	1420	2160
29	2250	3250	5470	3950	4550	5080	4030	2590	1170	1220	1340	2010
30	2350	3710	5180	4260	---	5770	3920	2600	1210	1190	1260	1920
31	2330	---	5220	5280	---	6420	---	2370	---	1020	1280	---
TOTAL	60350	64010	148590	126399	141360	132470	175300	91320	47670	34752	40362	51340
MEAN	1947	2134	4793	4077	4874	4273	5843	2946	1589	1121	1302	1711
MAX	2960	3710	7180	5330	6300	6420	9790	3810	2570	1460	1840	2340
MIN	1200	1600	2980	3200	3470	3560	3740	2030	1170	843	848	1280
CFSM	.53	.58	1.31	1.11	1.33	1.17	1.59	.80	.43	.31	.36	.47
IN.	.61	.65	1.51	1.28	1.43	1.34	1.78	.93	.48	.35	.41	.52

CAL YR 1987 TOTAL 1052010 MEAN 2882 MAX 7180 MIN 1150 CFSM .79 IN 10.68
WTR YR 1988 TOTAL 1113914 MEAN 3043 MAX 9790 MIN 843 CFSM .83 IN 11.30

04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1979 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1979 to September 1984.
WATER TEMPERATURE: February 1979 to September 1984.

INSTRUMENTATION.--Water-quality monitor from Oct. 9, 1980 to Sept. 30, 1984.

REMARKS.--Bimonthly cross-sectional samples were collected at Grant Street bridge 0.2 mi upstream from gage, or at bridge on Main Street.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1982, 1984): Maximum, 678 microsiemens, Feb. 16, 1982; minimum, 278 microsiemens, Mar. 19, 1982.
WATER TEMPERATURE (water years 1980, 1982-84): Maximum daily recorded (more than 20 percent missing record), 29.0°C, July 20, 21, 1980; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
16...	1300	1910	608	7.9	8.5	1.3	11.3	99	K14000	810
JAN										
26...	1430	3210	596	8.2	0.5	2.2	14.3	101	K200	1700
MAR										
22...	1330	3590	543	8.5	5.0	6.8	13.5	108	K270	K190
MAY										
17...	1430	2840	--	8.5	19.0	3.9	9.3	103	K38	K47
JUL										
28...	0800	1250	519	8.2	25.5	4.7	7.8	97	K170	820
SEP										
20...	1400	1690	484	8.1	19.0	6.0	7.2	80	>6000	K11000

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
16...	290	72	79	23	18	12	0.5	2.3	268	0
JAN										
26...	270	66	75	21	14	10	0.4	2.3	254	0
MAR										
22...	270	66	75	21	13	9	0.4	1.9	239	7
MAY										
17...	280	68	74	23	16	11	0.4	1.8	234	12
JUL										
28...	240	66	58	24	20	15	0.6	2.2	217	0
SEP										
20...	210	61	53	20	17	15	0.5	2.1	188	0

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)
NOV									
16...	220	51	29	0.20	6.5	352	0.48	1820	0.040
JAN									
26...	208	57	25	0.10	8.4	344	0.47	2980	0.030
MAR									
22...	208	55	23	0.20	5.6	335	0.46	3250	0.010
MAY									
17...	212	53	25	0.30	2.0	329	0.45	2520	0.030
JUL									
28...	178	50	32	0.30	1.4	311	0.42	1050	0.020
SEP									
20...	154	46	26	0.10	4.2	267	0.36	1220	0.030

04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
NOV										
16...	1.30	0.160	0.170	0.60	0.040	0.010	<0.010	<10	1	59
JAN										
26...	2.20	0.320	0.270	0.90	0.050	0.020	<0.010	--	--	--
MAR										
22...	1.90	0.120	0.120	0.70	0.020	<0.010	<0.010	<10	1	49
MAY										
17...	1.30	0.060	0.070	0.50	0.040	0.020	<0.010	<10	1	58
JUL										
28...	0.150	0.020	0.020	1.1	0.140	0.020	<0.010	--	--	--
SEP										
20...	0.880	0.150	0.140	1.0	0.080	0.020	<0.010	<10	2	49

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
NOV										
16...	<0.5	<1	<1	<3	<1	8	<5	4	9	<0.1
JAN										
26...	--	--	--	--	--	--	--	--	--	--
MAR										
22...	<0.5	<1	<1	<3	1	7	<5	9	16	<0.1
MAY										
17...	<0.5	<1	<1	<3	1	6	<5	9	3	<0.1
JUL										
28...	--	--	--	--	--	--	--	--	--	--
SEP										
20...	<0.5	2	6	<3	3	15	<5	5	10	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV										
16...	<10	<1	<1	<1.0	130	<6	10	12	62	75
JAN										
26...	--	--	--	--	--	--	--	10	87	90
MAR										
22...	<10	4	<1	1.0	130	<6	<3	6	58	65
MAY										
17...	<10	<1	<1	<1.0	130	<6	<3	18	138	89
JUL										
28...	--	--	--	--	--	--	--	18	61	79
SEP										
20...	<10	<1	<1	<1.0	100	<6	12	21	96	91

04101800 DOWAGIAC RIVER AT SUMNERVILLE, MI

LOCATION.--Lat 41°54'48" (revised), long 86°12'47", in SE1/4 sec.30, T.6 S., R.16 W., Cass County, Hydrologic Unit 04050001, on right bank 30 ft upstream from bridge on Indian Lake Road, 0.3 mi west of Sumnerville.

DRAINAGE AREA.--255 mi^2.

PERIOD OF RECORD.--October 1960 to current year.

GAGE.--Water-stage recorder. Datum of gage is 692.62 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by millpond and lake-level control dam upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--28 years, 288 ft^3/s, 15.34 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,590 ft^3/s, Feb. 24, 1985, gage height, 9.26 ft; minimum, 86 ft^3/s, Sept. 10, 1964; minimum gage height, 2.57 ft, Aug. 8, 9, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 889 ft^3/s, Apr. 7, gage height, 6.74 ft; minimum, 97 ft^3/s, July 9, 10, gage height, 2.75 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	219	247	347	329	600	392	437	317	184	118	116	143
2	214	245	335	304	530	396	405	308	180	117	110	139
3	234	244	320	310	457	383	420	291	184	115	106	165
4	224	239	322	298	417	347	483	286	178	113	108	274
5	214	230	306	255	387	328	445	278	172	111	108	216
6	210	224	292	277	341	322	569	269	172	108	118	193
7	256	222	301	281	355	324	859	263	167	105	112	180
8	337	223	362	279	348	332	697	256	162	103	109	169
9	290	220	392	280	344	350	548	263	162	99	196	163
10	258	215	368	261	339	339	478	279	155	106	185	153
11	266	211	339	271	330	326	438	266	153	130	177	150
12	254	213	329	273	333	322	410	263	153	118	165	149
13	240	213	307	271	326	326	386	260	149	114	155	151
14	230	212	293	263	317	327	374	247	145	111	147	146
15	221	209	395	265	398	328	359	246	142	106	152	142
16	214	209	478	266	418	325	347	272	140	135	152	138
17	216	210	420	356	391	322	340	255	138	174	144	140
18	216	212	375	577	375	349	346	241	136	165	139	139
19	214	214	354	522	368	350	333	234	131	170	205	167
20	254	215	638	550	361	347	326	229	141	175	188	284
21	323	218	655	519	346	329	343	225	144	184	166	258
22	329	219	526	439	350	326	332	221	135	167	157	254
23	312	223	457	393	405	332	340	214	132	178	163	316
24	308	230	430	372	375	344	330	270	129	161	162	284
25	312	284	434	352	347	397	317	246	124	152	151	246
26	289	342	404	331	331	381	306	225	121	149	145	226
27	287	312	376	330	357	344	362	218	121	139	145	210
28	278	296	367	322	357	338	418	210	121	131	170	197
29	270	330	366	318	378	408	363	205	124	123	158	189
30	261	347	346	395	---	556	335	199	120	123	150	183
31	251	---	344	552	---	514	---	193	---	121	146	---
TOTAL	8001	7228	11978	10811	10981	11104	12446	7749	4415	4121	4605	5764
MEAN	258	241	386	349	379	358	415	250	147	133	149	192
MAX	337	347	655	577	600	556	859	317	184	184	205	316
MIN	210	209	292	255	317	322	306	193	120	99	106	138
CFSM	1.01	.95	1.51	1.37	1.49	1.40	1.63	.98	.58	.52	.58	.75
IN.	1.17	1.05	1.75	1.58	1.60	1.62	1.82	1.13	.64	.60	.67	.84

CAL YR 1987 TOTAL 94368 MEAN 259 MAX 655 MIN 140 CFSM 1.02 IN 13.77
WTR YR 1988 TOTAL 99203 MEAN 271 MAX 859 MIN 99 CFSM 1.06 IN 14.47

04102500 PAW PAW RIVER AT RIVERSIDE, MI

LOCATION.--Lat 42°11'10", long 86°22'06", in SW1/4 SE1/4 sec.23, T.3 S., R.18 W., Berrien County, Hydrologic Unit 04050001, on left bank 40 ft upstream from bridge on Coloma Road, 0.8 mi east of Riverside.

DRAINAGE AREA.--390 mi².

PERIOD OF RECORD.--October 1951 to current year.

REVISED RECORDS.--WSP 1337: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 588.80 ft above National Geodetic Vertical Datum of 1929. May 10, 1966, to July 11, 1967, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 29 and Feb. 3-14. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation, principally during low flow, caused by paper mill upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--37 years, 451 ft³/s, 15.70 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,580 ft³/s, Oct. 4, 1986, gage height, 10.90 ft; minimum, 99 ft³/s, July 5, 1964, gage height, 2.66 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,240 ft³/s, Apr. 7, gage height, 8.52 ft; minimum, 176 ft³/s, Aug. 8, gage height, 3.39 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	383	488	651	680	811	604	732	612	287	223	203	219
2	370	479	670	640	839	630	697	588	287	222	199	206
3	389	471	657	600	830	647	727	556	285	221	201	210
4	397	457	643	540	820	643	823	506	281	216	196	244
5	387	446	634	510	810	622	833	466	280	211	190	236
6	381	438	614	520	800	599	834	444	277	205	188	266
7	404	427	596	540	780	574	1110	430	275	201	181	253
8	490	408	603	550	750	546	1170	420	273	196	178	227
9	587	394	681	560	720	532	1120	415	264	195	197	220
10	529	384	719	560	700	522	1170	419	255	196	221	227
11	458	376	698	560	680	515	1150	420	255	198	231	222
12	426	372	679	550	660	517	1010	422	256	198	239	206
13	400	374	682	540	640	520	832	421	256	197	242	212
14	379	366	671	530	620	513	713	413	253	199	235	227
15	365	358	669	520	688	503	650	403	250	195	226	241
16	356	357	698	520	717	497	601	412	245	200	218	220
17	352	356	758	550	722	496	556	414	232	236	231	210
18	356	354	728	700	700	502	528	411	235	242	244	215
19	360	360	702	950	657	520	504	405	241	255	258	248
20	379	365	814	1000	641	529	483	391	249	251	254	289
21	420	370	1140	1000	617	527	470	371	244	234	251	317
22	481	374	1100	950	587	520	466	361	238	230	257	338
23	539	379	1020	900	598	516	521	354	230	235	245	381
24	552	389	1040	850	621	511	595	350	231	237	224	399
25	550	417	1100	810	587	514	632	343	236	230	226	385
26	564	455	1070	760	571	546	606	334	232	226	242	383
27	570	496	968	720	574	541	626	327	225	228	239	394
28	562	519	888	690	582	522	660	323	216	232	225	399
29	548	540	834	640	585	535	685	321	218	225	221	374
30	533	585	780	612	---	617	645	313	219	209	227	332
31	508	---	720	697	---	751	---	301	---	212	233	---
TOTAL	13975	12554	24227	20749	19907	17131	22149	12666	7525	6755	6922	8300
MEAN	451	418	782	669	686	553	738	409	251	218	223	277
MAX	587	585	1140	1000	839	751	1170	612	287	255	258	399
MIN	352	354	596	510	571	496	466	301	216	195	178	206
CFSM	1.16	1.07	2.01	1.72	1.76	1.42	1.89	1.05	.64	.56	.57	.71
IN.	1.33	1.20	2.31	1.98	1.90	1.63	2.11	1.21	.72	.64	.66	.79

CAL YR 1987 TOTAL 157415 MEAN 431 MAX 1140 MIN 221 CFSM 1.11 IN 15.01
WTR YR 1988 TOTAL 172860 MEAN 472 MAX 1170 MIN 178 CFSM 1.21 IN 16.49

04102700 SOUTH BRANCH BLACK RIVER NEAR BANGOR, MI

LOCATION.--Lat 42°21'15", long 86°11'15", in NW1/4 sec.28, T.1 S., R.16 W., Van Buren County, Hydrologic Unit 04050002, on left bank 50 ft upstream from bridge on 66th Street, 4.9 mi northwest of Bangor.

DRAINAGE AREA.--83.6 mi^2.

PERIOD OF RECORD.--June 1966 to current year. Prior to October 1981, published as Black River near Bangor.

REVISED RECORDS.--WDR MI-81: 1973-75(M), 1979(M).

GAGE.--Water-stage recorder. Elevation of gage is 610 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Jan. 2-15, 25-28, and Feb. 6-14. Records good except for estimated daily discharges, which are fair. Occasional regulation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 107 ft^3/s, 17.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,860 ft^3/s, Sept. 30, 1986, gage height, 13.63 ft; minimum, 20 ft^3/s, Sept. 28, 1966, Aug. 18, 19, 1984; minimum gage height, 1.79 ft, Aug. 18, 19, 1984.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 21	1100	645	9.40	Feb. 1	1400	430	7.92
Jan. 18	2300	495	8.50	Apr. 7	1800	*726	*9.64

Minimum discharge, 23 ft^3/s, Aug. 8, 9, gage height, 1.82 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	77	107	228	146	418	195	226	109	41	28	27	26
2	75	138	200	135	357	195	172	93	40	26	25	26
3	124	131	179	130	261	187	193	81	42	29	26	28
4	112	116	166	120	198	154	273	77	40	28	25	32
5	91	104	151	115	166	130	269	73	39	28	25	31
6	80	94	139	115	145	121	297	71	39	26	26	29
7	105	86	133	115	130	118	643	68	38	27	24	28
8	185	82	211	115	120	120	602	67	37	27	24	28
9	141	80	283	115	115	130	404	69	37	26	32	27
10	103	76	277	115	115	131	283	80	36	26	32	26
11	90	73	213	116	115	120	209	77	36	28	31	26
12	83	72	184	116	115	117	165	72	35	27	30	26
13	77	71	163	117	120	118	142	71	36	27	29	28
14	73	70	139	118	130	114	133	67	34	27	27	28
15	68	69	144	120	172	113	126	65	34	26	29	27
16	65	67	239	124	178	111	116	78	34	28	30	27
17	64	66	263	199	165	111	109	76	33	33	29	27
18	66	67	220	435	151	129	107	69	33	31	28	28
19	65	68	182	470	142	140	102	65	33	32	30	38
20	78	69	368	397	136	131	97	62	32	30	30	43
21	141	73	613	400	124	122	98	60	34	30	27	35
22	251	75	484	310	124	117	96	58	32	29	26	37
23	268	84	341	221	171	115	120	56	33	30	29	94
24	207	106	281	171	164	111	147	57	34	31	30	67
25	176	136	322	140	132	119	125	55	32	30	28	53
26	151	227	326	120	119	138	111	53	31	31	27	44
27	136	204	254	110	139	121	124	49	31	30	27	40
28	128	154	197	110	157	109	181	46	27	28	30	38
29	116	165	174	109	175	129	164	44	28	27	29	35
30	105	228	162	154	---	246	128	43	30	27	27	34
31	97	---	153	309	---	315	---	42	---	27	27	---
TOTAL	3598	3158	7389	5507	4754	4327	5962	2053	1041	880	866	1056
MEAN	116	105	238	180	164	140	199	66.2	34.7	28.4	27.9	35.2
MAX	268	228	613	470	418	315	643	109	42	33	32	94
MIN	64	66	133	109	115	109	96	42	27	26	24	26
CFSM	1.39	1.26	2.85	2.15	1.96	1.68	2.38	.79	.42	.34	.33	.42
IN.	1.60	1.41	3.29	2.49	2.12	1.93	2.65	.91	.46	.39	.39	.47

CAL YR 1987 TOTAL 34854 MEAN 95.5 MAX 613 MIN 28 CFSM 1.14 IN 15.51
WTR YR 1988 TOTAL 40671 MEAN 111 MAX 643 MIN 24 CFSM 1.33 IN 18.10

04103010 KALAMAZOO RIVER NEAR MARENGO, MI

LOCATION.--Lat 42°15'42", long 84°51'21", in SW1/4 SE1/4 sec.26, T.2 S., R.5 W., Calhoun County, Hydrologic Unit 04050003, on right bank at upstream side of bridge on B Drive North, 0.8 mi south of Marengo, and 5.0 mi west of Albion.

DRAINAGE AREA.--267 mi^2.

PERIOD OF RECORD.--October 1986 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 910 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 17, Jan. 27-29, and Feb. 5-15. Records good except for estimated daily discharges, which are fair. Some diversion by pumping for irrigation. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 730 ft^3/s, Apr. 8, 1988; maximum gage height, 8.52 ft, Oct. 5, 1986; minimum, 88 ft^3/s, Aug. 19, 1987, gage height, 5.90 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 730 ft^3/s, Apr. 8, gage height, 8.47 ft; minimum, 94 ft^3/s, July 9, 10, 16, gage height, 5.95 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	160	174	228	200	398	224	303	228	149	109	107	115
2	159	176	221	195	408	227	285	220	150	106	103	113
3	159	177	211	190	360	241	300	214	152	104	101	116
4	153	170	204	185	312	239	322	210	150	102	100	143
5	144	164	192	185	260	223	346	206	147	99	109	165
6	143	160	183	180	245	217	403	201	143	99	124	159
7	143	158	181	180	230	217	624	200	139	96	118	152
8	141	154	197	180	225	224	724	197	132	96	111	144
9	142	151	240	180	215	260	691	198	136	95	110	135
10	138	150	255	175	215	286	579	201	134	99	113	127
11	140	150	252	175	210	271	461	201	131	107	115	123
12	140	148	249	170	210	271	398	197	129	105	118	125
13	139	147	232	160	210	291	365	192	128	104	113	128
14	138	146	221	140	215	289	348	187	125	101	109	127
15	136	146	288	155	250	266	335	190	122	97	121	125
16	135	145	343	180	277	244	318	202	120	99	118	125
17	135	149	342	215	262	229	305	197	121	134	116	125
18	132	155	313	265	247	225	291	192	118	115	136	127
19	130	151	278	297	248	222	285	189	116	119	155	159
20	138	147	329	298	248	218	277	192	114	116	152	204
21	147	145	369	295	231	213	264	196	114	115	141	178
22	151	142	354	267	240	210	256	185	116	113	132	200
23	156	143	316	246	258	211	274	181	128	130	151	570
24	165	143	292	226	271	218	256	180	118	126	145	438
25	173	187	284	216	246	278	255	175	114	131	137	363
26	177	218	281	180	225	324	246	172	108	128	128	297
27	194	233	269	205	227	309	245	166	108	124	124	237
28	194	218	259	205	225	286	254	162	109	122	134	205
29	192	229	250	200	221	305	252	159	112	117	127	187
30	182	231	220	221	---	333	240	156	110	112	122	173
31	172	---	210	295	---	328	---	153	---	109	120	---
TOTAL	4748	5007	8063	6461	7389	7899	10505	5899	3793	3429	3810	5585
MEAN	153	167	260	208	255	255	350	190	126	111	123	186
MAX	194	233	369	298	408	333	724	228	152	134	155	570
MIN	130	142	181	140	210	210	240	153	108	95	100	113
CFSM	.57	.63	.97	.78	.96	.96	1.31	.71	.47	.42	.46	.70
IN.	.66	.70	1.12	.90	1.03	1.10	1.46	.82	.53	.48	.53	.78

CAL YR 1987 TOTAL 65082 MEAN 178 MAX 369 MIN 96 CFSM .67 IN 9.07
WTR YR 1988 TOTAL 72588 MEAN 198 MAX 724 MIN 95 CFSM .74 IN 10.11

04105000 BATTLE CREEK AT BATTLE CREEK, MI

LOCATION.--Lat 42°19'55", long 85°09'15", in NW1/4 sec.5, T.2 S., R.7 W., Calhoun County, Hydrologic Unit 04050003, on right bank 350 ft upstream from Emmett Street Bridge in Battle Creek, 3.0 mi upstream from mouth.

DRAINAGE AREA.--241 mi².

PERIOD OF RECORD.--October 1930 to September 1931, October 1932 to July 1933, January 1934 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1931, 1944. WSP 1507: 1956.

GAGE.--Water-stage recorder. Datum of gage is 823.24 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to May 11, 1951, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 6-8, 13-29, Mar. 14-16, and May 20 to June 30. Records good except for estimated daily discharges, which are fair. Occasional slight regulation prior to November 1943. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--55 years (water years 1931, 1935-88), 203 ft³/s, 11.44 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,640 ft³/s, Apr. 7, 1947, gage height, 4.48 ft, from floodmark; minimum, 22 ft³/s, Aug. 14, 1934; minimum gage height, about -0.5 ft in July 1936 and on Aug. 31, 1939, due to opening of gates at dam forming control.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,330 ft³/s, Apr. 9, gage height, 2.46 ft; minimum, 24 ft³/s, July 8, 10, 15, 16, Aug. 4, gage height, 0.50 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	130	149	289	323	447	299	355	234	82	47	32	43
2	132	146	291	272	504	304	391	213	80	43	34	42
3	126	148	301	258	634	320	399	192	77	39	32	49
4	120	156	300	244	638	317	393	192	74	31	27	62
5	113	159	284	218	522	309	390	179	72	36	33	85
6	109	148	263	190	404	297	424	168	71	42	33	80
7	104	137	243	170	341	288	591	167	70	34	37	64
8	92	130	234	165	321	289	1070	162	69	26	42	68
9	98	127	246	167	302	314	1300	150	68	29	48	60
10	96	125	267	162	294	328	1120	160	68	27	45	55
11	88	122	303	158	283	343	896	169	67	30	40	45
12	89	117	359	146	261	354	727	153	66	31	46	44
13	89	111	390	145	244	357	599	143	65	31	56	56
14	83	111	385	140	230	350	498	142	63	28	46	61
15	84	111	379	140	243	330	428	131	60	30	51	50
16	91	109	385	135	260	310	383	139	56	32	50	46
17	80	105	393	135	273	300	346	145	54	49	46	42
18	87	104	438	150	292	290	318	140	52	40	54	48
19	89	104	491	250	316	276	294	125	50	48	65	85
20	85	99	512	420	325	266	274	120	49	53	59	151
21	105	97	551	540	302	257	261	115	48	50	54	177
22	126	98	656	600	286	245	247	110	45	45	45	190
23	132	90	774	620	280	230	249	110	47	50	50	235
24	137	95	733	600	288	235	258	110	47	59	64	257
25	140	129	659	550	299	239	267	105	46	51	65	273
26	139	173	592	400	298	248	277	100	45	63	58	293
27	142	215	545	300	300	253	276	96	43	64	46	293
28	160	239	487	260	293	260	263	93	36	48	45	252
29	160	266	389	230	294	272	251	90	43	42	51	192
30	158	285	346	234	---	295	245	87	50	40	46	152
31	150	---	360	340	---	321	---	85	---	36	40	---
TOTAL	3534	4205	12845	8662	9774	9096	13790	4325	1763	1274	1440	3550
MEAN	114	140	414	279	337	293	460	140	58.8	41.1	46.5	118
MAX	160	285	774	620	638	357	1300	234	82	64	65	293
MIN	80	90	234	135	230	230	245	85	36	26	27	42
CFSM	.47	.58	1.72	1.16	1.40	1.22	1.91	.58	.24	.17	.19	.49
IN.	.55	.65	1.98	1.34	1.51	1.40	2.13	.67	.27	.20	.22	.55

CAL YR 1987 TOTAL 58943 MEAN 161 MAX 774 MIN 48 CFSM .67 IN 9.10
WTR YR 1988 TOTAL 74258 MEAN 203 MAX 1300 MIN 26 CFSM .84 IN 11.46

04105500 KALAMAZOO RIVER NEAR BATTLE CREEK, MI

LOCATION.--Lat 42°19'26", long 85°11'51", in SW1/4 sec.1, T.2 S., R.8 W., Calhoun County, Hydrologic Unit 04050003, on left bank 20 ft upstream from bridge on Kendall Street in Battle Creek.

DRAINAGE AREA.--824 mi².

PERIOD OF RECORD.--July 1937 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 924: 1938-39. WSP 1387: 1938, 1945-46, 1948.

GAGE.--Water-stage recorder. Elevation of gage is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Oct. 1, 1957, water-stage recorder at site 4.7 mi downstream at different datum. Oct. 1, 1957, to June 15, 1959, nonrecording gage at bridge 1,800 ft upstream at different datum. June 16, 1959, to Oct. 13, 1960, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Oct. 1-21, Dec. 15 to Jan. 13, Jan. 27 to Feb. 18, June 14-27, and July 31 to Aug. 8. Records fair. Diurnal fluctuation below 1,500 ft³/s caused by powerplants upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--51 years, 667 ft³/s, 10.99 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,290 ft³/s, Apr. 7, 1947, gage height, 9.13 ft, site and datum then in use; minimum, 50 ft³/s, Sept. 22, 1939, site then in use; minimum daily, 86 ft³/s, Aug. 5, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,600 ft³/s, Apr. 9, gage height, 5.60 ft; minimum daily, 200 ft³/s, June 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	470	552	829	860	1090	813	1020	697	400	271	260	278
2	470	519	837	730	1210	857	972	690	384	266	255	245
3	460	509	765	620	1210	876	1080	653	400	259	255	279
4	440	529	740	680	1210	849	1040	603	390	247	260	355
5	425	506	716	720	1100	840	1070	624	374	241	275	372
6	425	497	692	610	800	764	1240	537	369	246	305	373
7	420	473	657	560	600	799	1780	570	379	246	285	347
8	420	477	675	570	700	817	2250	590	369	238	280	340
9	415	443	785	590	800	853	2570	543	344	234	276	316
10	410	470	876	630	920	892	2310	550	334	257	260	272
11	410	449	863	710	800	921	1890	556	324	236	258	273
12	410	468	942	700	720	990	1580	543	329	253	265	303
13	405	456	900	560	730	866	1380	530	339	263	256	275
14	405	417	885	498	770	978	1240	524	320	296	259	292
15	400	421	910	495	850	876	1050	518	310	203	354	301
16	400	407	1020	518	960	850	1010	518	300	281	292	282
17	395	447	1090	622	940	869	981	550	300	334	277	254
18	390	414	1100	860	940	755	927	545	295	324	329	301
19	380	444	1170	938	806	735	874	525	295	344	379	513
20	400	422	1270	1110	885	734	824	511	290	310	307	655
21	410	436	1250	1350	842	722	840	509	290	301	316	574
22	424	406	1250	1220	767	729	807	504	290	310	316	654
23	455	414	1300	1150	790	677	857	502	320	283	348	1350
24	489	453	1350	1070	787	693	816	490	300	329	330	1320
25	503	646	1300	905	850	772	874	505	290	354	324	1050
26	482	688	1200	731	817	786	874	484	270	354	296	883
27	547	716	1160	730	804	841	832	434	200	334	278	811
28	560	791	1190	740	797	840	883	428	208	305	301	715
29	587	847	990	750	795	918	767	422	266	301	315	583
30	549	842	820	780	---	963	751	379	270	261	292	518
31	539	---	880	910	---	1050	---	411	---	265	253	---
TOTAL	13895	15559	30412	23917	25300	25925	35389	16445	9549	8746	9056	15084
MEAN	448	519	981	772	872	836	1180	530	318	282	292	503
MAX	587	847	1350	1350	1210	1050	2570	697	400	354	379	1350
MIN	380	406	657	495	600	677	751	379	200	203	253	245
CFSM	.54	.63	1.19	.94	1.06	1.02	1.43	.64	.39	.34	.35	.61
IN.	.63	.70	1.37	1.08	1.14	1.17	1.60	.74	.43	.39	.41	.68

CAL YR 1987 TOTAL 209283 MEAN 573 MAX 1350 MIN 221 CFSM .70 IN 9.45
WTR YR 1988 TOTAL 229277 MEAN 626 MAX 2570 MIN 200 CFSM .76 IN 10.35

04105700 AUGUSTA CREEK NEAR AUGUSTA, MI

LOCATION.--Lat 42°21'12", long 85°21'14", in SW1/4 sec.27, T.1 S., R.9 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank 15 ft downstream from bridge on EF Road, 1.3 mi north of Augusta.

DRAINAGE AREA.--38.9 mi².

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 15, 1965, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 44.0 ft³/s, 15.36 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 560 ft³/s, June 27, 1978, gage height, 3.41 ft; minimum, 8.9 ft³/s, Jan. 26, 1978, result of freezeup; minimum gage height, 0.65 ft, Jan. 19, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 122 ft³/s, Sept. 23, gage height, 2.23 ft; minimum, 15 ft³/s, July 15, gage height, 0.72 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	38	41	57	49	79	49	69	39	28	21	22	24
2	37	43	54	46	75	52	63	39	30	20	20	24
3	37	42	50	45	65	55	67	46	30	19	20	27
4	35	40	48	42	56	49	73	44	29	18	19	38
5	33	37	45	39	48	47	70	42	28	18	30	37
6	33	36	42	43	46	46	78	40	28	17	41	34
7	32	35	43	42	49	48	99	39	27	17	34	32
8	32	34	53	42	43	52	97	38	26	17	30	30
9	31	36	61	42	43	64	84	39	25	17	32	28
10	31	35	59	42	43	64	73	42	25	17	31	27
11	31	34	55	42	40	60	65	41	24	18	30	25
12	31	34	54	40	42	58	59	40	23	18	30	27
13	30	34	50	38	43	60	55	39	23	18	27	29
14	30	34	46	33	40	58	55	38	22	17	26	27
15	29	34	55	37	60	55	53	37	22	17	40	26
16	29	33	62	36	60	53	50	41	21	19	34	25
17	31	34	61	52	54	51	48	40	21	24	29	25
18	32	35	57	73	50	51	48	38	21	24	31	31
19	32	34	55	70	49	50	46	36	20	25	33	52
20	43	35	76	70	48	50	46	35	23	25	31	75
21	50	33	81	66	41	48	46	34	23	25	28	73
22	50	33	72	57	47	47	46	34	23	28	27	75
23	47	34	64	50	49	47	60	35	26	51	33	112
24	46	34	63	47	47	49	63	38	24	45	34	106
25	47	52	69	44	45	55	58	35	22	38	30	85
26	43	59	66	38	44	57	56	33	20	34	28	69
27	46	54	59	45	47	55	57	32	20	30	27	57
28	43	49	56	42	46	53	49	31	20	28	29	49
29	41	54	55	41	47	61	43	31	23	27	28	44
30	38	58	50	49	---	75	41	30	21	26	26	40
31	38	---	55	70	---	75	---	29	---	24	25	---
TOTAL	1146	1180	1773	1472	1446	1694	1817	1155	718	742	905	1353
MEAN	37.0	39.3	57.2	47.5	49.9	54.6	60.6	37.3	23.9	23.9	29.2	45.1
MAX	50	59	81	73	79	75	99	46	30	51	41	112
MIN	29	33	42	33	40	46	41	29	20	17	19	24
CFSM	.95	1.01	1.47	1.22	1.28	1.40	1.56	.96	.61	.61	.75	1.16
IN.	1.10	1.13	1.70	1.41	1.38	1.62	1.74	1.10	.69	.71	.87	1.29

CAL YR 1987 TOTAL 15418 MEAN 42.2 MAX 81 MIN 21 CFSM 1.09 IN 14.74
WTR YR 1988 TOTAL 15401 MEAN 42.1 MAX 112 MIN 17 CFSM 1.08 IN 14.73

04106000 KALAMAZOO RIVER AT COMSTOCK, MI

LOCATION.--Lat 42°17'08" (revised), long 85°30'50", in NE1/4 sec.19, T.2 S., R.10 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank at downstream side of bridge on River Street in Comstock, 0.2 mi downstream from Comstock Creek.

DRAINAGE AREA.--1,010 mi², approximately.

PERIOD OF RECORD.--April to August 1931, October 1932 to December 1979, October 1984 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 824: 1933-36. WSP 1387: 1933, 1934(M), 1935, 1936(M), 1938(M), 1940(M), 1941.

GAGE.--Water-stage recorder. Datum of gage is 756.12 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1987, at datum 3.00 ft higher. Prior to November 1945, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplant 1.2 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--51 years (water years 1933-79, 1985-88), 862 ft³/s, 11.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,910 ft³/s, Apr. 8, 1947, gage height, 7.94 ft, datum then in use; minimum, 119 ft³/s, May 29, 1958; minimum gage height, 0.09 ft, May 29, 1958, May 23, 1987, datum then in use; minimum daily discharge, 185 ft³/s, Aug. 7, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,200 ft³/s, Apr. 10, gage height, 7.40 ft; minimum, 273 ft³/s, July 6, gage height, 3.45 ft; minimum daily, 340 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	871	788	1100	1270	1490	1140	1410	1000	457	403	364	457
2	740	800	1170	1080	1750	1150	1320	1010	693	402	471	406
3	649	799	1140	879	1780	1300	1460	1040	675	395	340	407
4	595	730	1130	989	1770	1240	1460	883	554	393	341	479
5	654	792	1110	1040	1790	1120	1410	842	558	384	453	652
6	662	768	1090	920	1300	1180	1510	857	560	388	503	598
7	647	680	1060	793	871	1060	1890	856	558	353	485	516
8	660	647	1050	809	977	1090	2080	877	558	359	531	521
9	579	785	1070	844	1050	1210	2240	915	556	358	495	521
10	635	672	1110	882	1290	1270	2830	850	518	356	485	517
11	660	667	1180	1010	1330	1310	2740	848	452	366	466	421
12	511	670	1280	1030	1020	1240	2220	847	494	368	463	455
13	644	664	1280	905	1060	1310	1820	851	513	369	344	469
14	591	673	1370	793	1060	1360	1660	827	530	369	423	455
15	511	668	1270	796	1190	1330	1540	822	472	373	486	487
16	579	611	1520	798	1360	1200	1340	825	476	347	597	448
17	592	633	1600	922	1340	1170	1280	815	470	389	463	409
18	511	705	1530	1090	1300	1220	1330	782	441	514	452	462
19	575	626	1590	1250	1140	1110	1230	819	444	535	523	674
20	723	684	1870	1420	1080	1060	1170	808	407	533	521	911
21	733	685	1810	1610	1190	1040	1080	802	445	448	520	1050
22	662	636	1760	1650	1210	1030	1050	792	420	410	517	985
23	723	630	1840	1500	1170	1020	1070	773	436	460	462	1640
24	712	624	1940	1490	1100	1010	1200	782	530	511	461	1810
25	712	848	1860	1390	1090	1040	1150	771	428	537	553	1640
26	852	1000	1780	1150	1150	1080	1140	771	456	519	518	1360
27	754	999	1620	1050	1150	1120	1120	703	404	534	512	1140
28	786	1000	1730	1040	1140	1170	1080	643	394	433	465	1160
29	889	1020	1430	1050	1140	1270	1160	682	384	468	438	1020
30	798	1070	1140	1110	---	1280	1060	714	384	496	511	896
31	800	---	1290	1320	---	1490	---	503	---	347	406	---
TOTAL	21010	22574	43720	33880	36288	36620	45050	25310	14667	13117	14569	22966
MEAN	678	752	1410	1093	1251	1181	1502	816	489	423	470	766
MAX	889	1070	1940	1650	1790	1490	2830	1040	693	537	597	1810
MIN	511	611	1050	793	871	1010	1050	503	384	347	340	406
CFSM	.67	.75	1.40	1.08	1.24	1.17	1.49	.81	.48	.42	.47	.76
IN.	.77	.83	1.61	1.25	1.34	1.35	1.66	.93	.54	.48	.54	.85

CAL YR 1987 TOTAL 299347 MEAN 820 MAX 1940 MIN 413 CFSM .81 IN 11.03
WTR YR 1988 TOTAL 329771 MEAN 901 MAX 2830 MIN 340 CFSM .89 IN 12.15

04106180 PORTAGE CREEK AT PORTAGE, MI

LOCATION.--Lat 42°12'21", long 85°35'23", in SE1/4 sec.16, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank 750 ft upstream from bridge on Westnedge Avenue in Portage.

DRAINAGE AREA.--16.5 mi^2.

PERIOD OF RECORD.--October 1982 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Jan. 6-12. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--6 years, 18.6 ft^3/s, 15.31 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 63 ft^3/s, July 16, 1986, gage height, 3.41 ft; maximum gage height, 3.52 ft, Oct. 19, 1985; minimum daily discharge, 10 ft^3/s, Sept. 15, 1988; minimum gage height, 1.79 ft, June 8, 9, 10, 16, 17, 18, 19, 1987.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 55 ft^3/s, Sept. 19, gage height, 3.45 ft; minimum daily, 10 ft^3/s, Sept. 15; minimum gage height, 1.86 ft, June 17, 18, 20.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16	16	19	19	30	20	21	21	15	13	14	11
2	16	16	18	19	24	20	21	21	16	13	13	11
3	16	16	18	19	22	20	25	20	16	13	13	12
4	15	15	17	18	20	19	26	20	16	13	13	16
5	15	15	16	18	20	18	22	20	15	13	14	17
6	14	15	16	18	19	18	30	20	15	12	15	14
7	14	15	17	18	18	18	35	19	15	12	14	13
8	14	15	21	18	18	19	27	19	14	13	12	12
9	14	15	23	18	18	21	24	20	14	13	14	12
10	13	14	20	17	18	20	22	21	14	13	14	11
11	14	14	18	17	18	19	22	20	14	14	14	11
12	14	15	18	17	18	19	22	20	13	13	13	11
13	14	15	16	17	18	20	21	19	13	13	12	11
14	13	14	16	17	18	19	22	19	13	13	12	11
15	13	14	24	17	24	19	21	19	13	14	23	10
16	13	14	24	17	21	19	21	19	13	16	17	11
17	14	15	21	23	20	18	21	19	13	16	15	11
18	13	15	19	28	19	19	21	18	12	15	15	19
19	13	15	20	24	19	19	21	17	13	15	16	30
20	19	15	35	26	19	19	20	17	14	18	15	38
21	24	15	28	24	18	18	21	17	14	16	14	25
22	23	15	24	21	18	18	21	17	15	16	13	26
23	20	15	22	20	19	19	30	17	16	15	15	42
24	19	15	23	19	18	20	26	17	15	15	14	28
25	18	26	26	19	18	21	24	17	14	18	13	21
26	17	23	23	19	18	21	23	17	13	16	12	18
27	18	19	21	18	19	19	24	16	13	15	12	16
28	18	19	21	18	19	20	24	16	13	15	14	16
29	17	22	20	18	19	23	23	16	14	14	13	15
30	16	20	20	22	---	29	22	16	14	14	12	15
31	16	---	20	32	---	23	---	15	---	14	12	---
TOTAL	493	487	644	615	567	614	703	569	422	443	432	514
MEAN	15.9	16.2	20.8	19.8	19.6	19.8	23.4	18.4	14.1	14.3	13.9	17.1
MAX	24	26	35	32	30	29	35	21	16	18	23	42
MIN	13	14	16	17	18	18	20	15	12	12	12	10
CFSM	.96	.98	1.26	1.20	1.19	1.20	1.42	1.12	.86	.87	.84	1.04
IN.	1.11	1.10	1.45	1.39	1.28	1.38	1.58	1.28	.95	1.00	.97	1.16

CAL YR 1987 TOTAL 6135 MEAN 16.8 MAX 38 MIN 12 CFSM 1.02 IN 13.83
WTR YR 1988 TOTAL 6503 MEAN 17.8 MAX 42 MIN 10 CFSM 1.08 IN 14.66

04106300 PORTAGE CREEK NEAR KALAMAZOO, MI

LOCATION.--Lat 42°14'46", long 85°34'33", in SE1/4 sec.34, T.2 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank 5 ft upstream from bridge on Lovers Lane, 3.0 mi south of Kalamazoo.

DRAINAGE AREA.--22.4 mi^2.

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 814.88 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 17-24, June 6-29, and Sept. 9-14. Records fair. Flow includes water which is pumped from ground-water sources by industry and discharged into stream 2.0 mi upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 40.3 ft^3/s, 24.43 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 290 ft^3/s, June 26, 1978, gage height, 4.49 ft; minimum, 8.0 ft^3/s, Jan. 19, 1965, gage height, 0.88 ft, result of bridge construction upstream.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Apr. 6	1900	128	1.92	Sept. 23	0300	*188	*2.21
Sept. 19	2200	139	1.99				

Minimum daily discharge, 20 ft^3/s, Aug. 4, 8, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	28	43	47	41	73	49	52	31	24	26	24	24
2	30	42	47	40	62	53	51	32	29	25	25	23
3	28	43	49	40	54	54	70	29	27	25	23	26
4	26	42	45	45	51	51	62	30	27	24	20	31
5	28	41	46	43	49	47	53	31	25	26	35	27
6	28	39	44	44	47	45	87	30	25	26	28	27
7	29	36	52	43	44	49	73	32	25	25	21	25
8	26	37	60	43	48	53	57	31	25	26	20	25
9	26	37	63	41	48	61	51	32	25	26	34	25
10	24	36	56	39	48	54	50	34	24	27	25	24
11	24	33	52	43	47	54	51	32	24	33	26	24
12	26	34	51	41	44	54	49	32	23	30	25	25
13	26	35	47	41	41	49	46	31	23	28	22	26
14	26	33	49	41	41	49	39	32	23	29	20	25
15	28	30	66	45	68	45	35	34	22	34	60	24
16	27	33	65	47	53	45	34	34	22	42	28	25
17	27	36	56	69	53	48	39	31	22	36	25	25
18	23	40	52	72	50	50	42	33	22	29	27	51
19	25	37	50	61	47	44	35	30	23	30	31	66
20	39	36	96	65	50	43	34	31	25	36	28	89
21	48	35	64	55	45	47	38	30	26	32	27	44
22	43	40	55	50	54	47	37	29	27	31	24	56
23	39	43	47	44	50	49	55	32	28	26	29	130
24	38	60	49	45	47	52	45	32	26	24	25	53
25	34	75	54	48	46	56	44	30	24	38	24	37
26	34	53	49	49	48	51	37	28	23	29	25	33
27	38	46	42	49	50	44	44	27	24	26	26	32
28	38	45	48	47	46	58	44	26	25	25	30	31
29	32	53	46	47	53	62	38	26	27	24	27	31
30	37	50	48	55	---	79	33	27	26	25	25	30
31	44	---	47	82	---	56	---	28	---	23	23	---
TOTAL	969	1243	1642	1515	1457	1598	1425	947	741	886	832	1114
MEAN	31.3	41.4	53.0	48.9	50.2	51.5	47.5	30.5	24.7	28.6	26.8	37.1
MAX	48	75	96	82	73	79	87	34	29	42	60	130
MIN	23	30	42	39	41	43	33	26	22	23	20	23

CAL YR 1987 TOTAL 14921 MEAN 40.9 MAX 111 MIN 21
WTR YR 1988 TOTAL 14369 MEAN 39.3 MAX 130 MIN 20

04106320 WEST FORK PORTAGE CREEK NEAR OSHTEMO, MI

LOCATION.--Lat 42°14'07", long 85°38'54", in SE1/4 sec.1, T.3 S., R.12 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank at upstream side of culvert on 12th Street, 2.1 mi southeast of Oshtemo.

DRAINAGE AREA.--13.0 mi².

PERIOD OF RECORD.--May 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 868.86 ft, Kalamazoo County Road Commission datum.

REMARKS.--Estimated daily discharges: Aug. 15-22. Records good except for estimated daily discharges, which are fair. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--16 years, 6.57 ft³/s, 6.86 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26 ft³/s, Aug. 31, 1975, gage height, 2.15 ft; minimum, 0.38 ft³/s, July 14, 15, 1988, gage height, 0.89 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 12 ft³/s, Sept. 22-24; maximum gage height, 1.60 ft, Sept. 22; minimum discharge, 0.38 ft³/s, July 14, 15, gage height, 0.89 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.2	4.6	5.7	5.1	7.4	4.5	6.3	3.5	1.8	1.2	1.7	1.8
2	5.1	4.6	5.5	4.8	7.3	4.6	6.1	3.3	1.8	1.1	1.6	1.7
3	5.0	4.3	5.3	4.6	6.5	4.5	6.8	3.1	1.7	.96	1.4	1.8
4	5.0	4.1	5.1	4.5	6.1	4.3	7.5	3.0	1.6	.95	1.3	2.4
5	4.7	4.1	4.9	4.4	5.6	4.3	6.8	2.9	1.5	.94	1.3	2.7
6	4.6	4.1	4.7	4.4	5.4	4.3	7.1	2.9	1.3	.88	1.3	2.6
7	4.6	3.9	4.5	4.4	5.4	4.2	7.8	2.8	1.3	.81	1.2	2.5
8	4.6	4.1	5.1	4.5	5.4	4.4	7.1	2.8	1.2	.76	1.2	2.5
9	4.5	4.1	5.9	4.5	5.2	5.0	6.5	3.0	.98	.70	1.9	2.3
10	4.3	4.1	5.7	4.4	4.8	5.0	6.0	3.3	.81	.69	1.9	2.3
11	4.3	4.1	5.5	4.4	4.7	4.7	5.5	3.1	.78	.72	2.0	2.2
12	4.3	4.1	5.5	4.1	4.6	4.8	5.2	2.9	.79	.66	1.9	2.1
13	4.2	4.1	5.2	4.0	4.6	4.7	4.8	2.9	.83	.63	1.9	2.1
14	4.2	4.0	4.9	4.1	4.6	4.6	4.6	2.8	.83	.53	1.8	2.1
15	4.1	3.9	5.6	4.1	5.3	4.4	4.3	2.7	.81	.50	3.0	1.9
16	4.0	3.9	6.3	4.3	5.7	4.4	4.0	2.9	.74	.80	2.3	1.9
17	4.1	4.0	6.3	5.2	5.5	4.4	3.8	2.8	.74	1.2	2.1	2.1
18	4.1	4.3	5.9	7.0	5.3	4.4	3.7	2.6	.71	1.2	2.2	2.8
19	3.9	4.4	5.6	7.2	5.1	4.4	3.5	2.5	.61	1.3	2.4	4.5
20	4.8	4.3	7.3	7.5	5.0	4.4	3.4	2.4	.75	1.4	2.4	7.7
21	6.3	4.2	7.6	7.0	4.7	4.4	3.4	2.4	.72	1.4	2.3	8.5
22	6.9	4.0	7.2	6.3	4.7	4.4	3.4	2.2	.96	1.6	2.3	8.9
23	6.7	4.1	6.5	5.7	4.6	4.4	3.9	2.2	1.5	1.7	2.5	12
24	6.2	4.0	6.1	5.4	4.4	4.4	4.1	2.4	1.4	1.7	2.4	12
25	5.7	5.1	6.2	5.2	4.4	4.9	4.1	2.2	1.4	1.9	2.3	10
26	5.2	5.7	6.1	5.1	4.5	5.0	4.0	2.2	1.3	1.9	2.2	8.7
27	5.0	5.5	5.7	5.0	4.6	4.7	4.3	2.1	1.3	1.8	2.1	7.5
28	5.1	5.3	5.6	4.9	4.6	4.8	4.3	1.9	1.3	1.8	2.2	6.1
29	4.9	5.9	5.8	4.8	4.5	5.5	4.0	1.8	1.3	1.7	2.1	5.3
30	4.6	5.9	5.5	5.2	---	6.6	3.7	1.8	1.2	1.9	1.9	4.8
31	4.4	---	5.5	6.4	---	6.6	---	1.8	---	1.8	1.8	---
TOTAL	150.6	132.8	178.3	158.5	150.5	146.0	150.0	81.2	33.96	37.13	60.9	135.8
MEAN	4.86	4.43	5.75	5.11	5.19	4.71	5.00	2.62	1.13	1.20	1.96	4.53
MAX	6.9	5.9	7.6	7.5	7.4	6.6	7.8	3.5	1.8	1.9	3.0	12
MIN	3.9	3.9	4.5	4.0	4.4	4.2	3.4	1.8	.61	.50	1.2	1.7
CFSM	.37	.34	.44	.39	.40	.36	.39	.20	.09	.09	.15	.35
IN.	.43	.38	.51	.45	.43	.42	.43	.23	.10	.11	.17	.39

CAL YR 1987 TOTAL 1764.50 MEAN 4.83 MAX 9.9 MIN 1.5 CFSM .37 IN 5.05
WTR YR 1988 TOTAL 1415.69 MEAN 3.87 MAX 12 MIN .50 CFSM .30 IN 4.05

04106400 WEST FORK PORTAGE CREEK AT KALAMAZOO, MI

LOCATION.--Lat 42°14'40", long 85°36'50", in NE1/4 sec.5, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank 30 ft upstream from culvert on Oakland Drive, 2.5 mi upstream from mouth, and 3.7 mi southwest of main business district of Kalamazoo.

DRAINAGE AREA.--18.7 mi².

PERIOD OF RECORD.--September 1959 to current year.

GAGE.--Water-stage recorder and V-notch sharp-crested weir. Datum of gage is 858.09 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Jan. 2-18, 25-29, and Feb. 5-27. Records fair. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 9.73 ft³/s, 7.07 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 41 ft³/s, Apr. 19, 1975, gage height, 3.32 ft; minimum, 0.91 ft³/s, June 19, 20, 1988; minimum gage height, 0.88 ft, July 30, 1963, caused by construction.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 25 ft³/s, Sept. 23, gage height, 2.94 ft; minimum, 0.91 ft³/s, June 19, 20, gage height, 2.08 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.8	6.7	8.4	7.2	11	7.0	12	6.1	4.5	2.5	2.5	2.8
2	6.4	6.5	7.8	6.7	10	7.0	11	5.7	4.4	2.2	2.3	2.8
3	6.3	6.7	7.5	6.4	9.5	6.9	12	5.3	4.2	1.9	2.2	3.1
4	6.0	6.4	7.2	6.2	8.9	6.6	13	5.6	4.0	2.3	2.2	4.0
5	5.8	5.5	6.8	6.1	8.3	6.3	12	5.6	3.8	2.8	2.5	4.0
6	5.8	3.5	6.4	6.0	8.1	6.2	13	5.6	3.7	2.8	2.7	3.8
7	5.6	3.0	6.5	6.1	8.0	5.9	14	5.6	3.5	2.9	2.3	3.6
8	5.5	3.1	7.3	6.1	7.9	6.2	11	5.5	3.4	2.4	2.2	3.5
9	5.3	3.3	8.3	6.0	7.6	7.4	9.8	5.7	3.0	2.0	3.8	3.4
10	5.0	3.4	8.1	6.0	7.2	7.2	8.9	5.7	2.6	1.8	3.3	3.4
11	5.1	3.4	7.7	5.6	7.0	6.9	8.1	5.5	2.5	2.4	3.1	3.4
12	5.1	3.7	7.7	5.2	6.9	6.9	7.4	5.5	2.5	2.1	2.9	3.4
13	4.9	3.8	7.2	5.0	6.8	7.0	7.1	5.2	2.4	1.4	2.8	3.4
14	4.9	3.9	6.7	4.9	7.0	6.8	7.1	5.2	2.0	1.2	2.6	3.3
15	4.7	3.9	8.3	4.8	7.7	6.6	6.7	5.3	1.9	1.7	4.4	3.2
16	4.6	4.1	9.5	5.2	8.5	6.3	6.4	5.4	2.0	2.4	3.3	3.1
17	4.7	4.3	8.7	10	8.0	6.0	6.3	5.0	1.9	2.4	2.9	3.2
18	4.7	4.6	8.1	11	7.8	6.1	6.4	4.9	1.6	2.1	3.0	4.1
19	4.7	4.7	7.9	11	7.6	6.0	5.9	4.7	1.1	2.0	3.4	6.5
20	6.0	4.7	12	12	7.3	6.0	5.7	4.5	1.1	2.0	3.5	13
21	7.7	4.7	11	11	7.1	6.0	5.6	4.5	1.2	2.5	3.4	11
22	8.8	4.7	10	9.8	7.0	5.8	5.7	4.3	1.3	2.8	3.2	11
23	8.9	4.9	9.2	8.9	6.9	5.8	7.0	4.3	1.9	3.2	3.7	24
24	8.9	5.1	8.9	8.4	6.8	7.9	6.5	4.0	1.9	2.9	3.6	19
25	8.6	7.2	9.3	7.9	6.7	17	6.1	4.5	1.5	3.3	3.6	15
26	8.2	8.0	8.6	7.6	6.8	18	6.0	5.7	1.2	2.8	3.3	13
27	7.8	7.5	7.8	7.4	6.8	15	7.0	5.0	1.2	2.6	3.2	11
28	7.6	7.5	7.6	7.3	6.8	13	7.3	4.8	1.2	2.5	3.4	9.0
29	7.2	8.5	9.0	7.2	7.0	14	6.9	4.8	1.3	2.5	3.2	7.7
30	7.0	8.5	8.0	7.4	---	16	6.4	5.4	2.0	2.8	3.1	7.0
31	6.7	---	7.7	9.9	---	14	---	5.0	---	2.6	2.9	---
TOTAL	195.3	155.8	255.2	230.3	223.0	263.8	248.3	159.9	70.8	73.8	94.5	208.7
MEAN	6.30	5.19	8.23	7.43	7.69	8.51	8.28	5.16	2.36	2.38	3.05	6.96
MAX	8.9	8.5	12	12	11	18	14	6.1	4.5	3.3	4.4	24
MIN	4.6	3.0	6.4	4.8	6.7	5.8	5.6	4.0	1.1	1.2	2.2	2.8
CFSM	.34	.28	.44	.40	.41	.46	.44	.28	.13	.13	.16	.37
IN.	.39	.31	.51	.46	.44	.52	.49	.32	.14	.15	.19	.42

CAL YR 1987 TOTAL 2745.2 MEAN 7.52 MAX 17 MIN 3.0 CFSM .40 IN 5.46
WTR YR 1988 TOTAL 2179.4 MEAN 5.95 MAX 24 MIN 1.1 CFSM .32 IN 4.34

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI

(National stream quality accounting network station)

LOCATION.--Lat 42°35'36", long 85°59'03", in NE1/4 sec.5, T.2 N., R.14 W., Allegan County, Hydrologic Unit 04050003, on left bank 40 ft upstream from bridge on State Highway 89, 2.1 mi downstream from Swan Creek, 4.0 mi downstream from Calkins Dam, and 6.1 mi east of Fennville.

DRAINAGE AREA.--1,600 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1929 to September 1936, October 1937 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "near Allegan" April 1929 to September 1932; as "at Calkins Bridge, near Allegan" October 1932 to September 1936, and October 1937 to September 1938; as "at Calkins Dam, near Allegan" October 1938 to September 1950.

REVISED RECORDS.--WSP 1387: 1929(M), 1930, 1933, 1934-36(M), 1938(M), 1939-40, 1942.

GAGE.--Water-stage recorder. Datum of gage is 586.51 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). April 1929 to September 1936 at bridge and October 1937 to September 1950 in powerplant, 4.0 mi upstream at NGVD (levels by City of Allegan).

REMARKS.--Estimated daily discharges: Jan. 6-19 and Feb. 8-14. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated at low and medium stages by powerplants upstream from station and since June 1936 by Calkins Dam and powerplant, 4.0 mi upstream from station.

AVERAGE DISCHARGE.--58 years, 1,443 ft³/s, 12.25 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,500 ft³/s, Apr. 11, 1947, gage height, 606.76 ft, site and datum then in use; minimum daily, 50 ft³/s, Aug. 19, 1976, caused by shutting off flow at Calkins Dam.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,120 ft³/s, Dec. 22, gage height, 11.55 ft; minimum daily, 502 ft³/s, July 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1330	1690	2010	1910	2290	1950	2250	1700	825	665	777	735
2	1330	1630	2010	1920	3060	2090	2170	1610	829	662	686	772
3	1660	1750	1970	1920	2950	2220	2180	1350	895	661	559	731
4	1360	1350	1980	1870	2910	2060	2320	1470	1000	657	509	928
5	1160	1630	2000	1560	2890	1890	2700	1640	1010	652	549	697
6	928	1210	1970	1200	2410	1880	2610	1440	925	644	658	729
7	1380	1490	1850	1600	2170	1890	2970	1100	842	618	692	936
8	1590	1490	1880	1900	1800	1890	3140	1320	839	502	759	982
9	1070	1210	1950	1500	1700	1870	3140	1610	843	514	917	881
10	1070	1200	2180	1400	2000	1880	3030	1540	833	516	1060	685
11	1070	1260	2180	1400	2100	1890	3240	1310	829	517	900	684
12	1090	1250	2060	1600	2000	2040	3640	1090	836	516	597	703
13	1120	1250	2040	1800	1980	2190	3810	1420	800	518	648	758
14	1100	1450	2100	1900	1950	2010	3160	1390	707	509	755	668
15	1090	1260	2350	1500	1920	1820	2250	1060	695	530	757	708
16	1080	1220	2430	1300	2060	1870	2190	1420	767	624	756	772
17	1050	1180	2410	1500	2260	1880	2070	1300	807	1110	875	817
18	1030	1150	2410	1800	2320	1840	1730	1180	737	801	912	766
19	1090	1120	2420	2300	2210	1830	1780	1420	655	733	818	908
20	1110	1200	2800	2430	2070	1870	1900	1380	662	669	634	1280
21	1450	1250	3750	2650	1920	1820	1840	1060	775	725	604	1700
22	1780	1250	3920	3090	1820	1690	1840	1290	777	804	848	1520
23	1470	1250	3190	2750	1900	1610	1910	1130	791	763	845	2570
24	1420	1250	2830	2530	2060	1630	1940	1130	790	636	790	2720
25	1470	1280	3370	2240	1970	1690	1920	1080	782	1230	834	2620
26	1490	1630	3530	2160	1790	1720	1870	1080	771	702	679	2480
27	1510	1960	3270	2220	1880	1740	1790	1160	678	686	694	2010
28	1600	1910	2770	2030	1940	1740	1740	1080	687	667	749	1620
29	1600	1880	2630	1900	1950	1790	1770	1020	709	785	854	1420
30	1370	1930	2720	1910	---	2140	1750	1190	674	746	828	1430
31	1440	---	2450	2020	---	2770	---	908	---	686	686	---
TOTAL	40308	42580	77430	59810	62280	59200	70650	39878	23770	21048	23229	36230
MEAN	1300	1419	2498	1929	2148	1910	2355	1286	792	679	749	1208
MAX	1780	1960	3920	3090	3060	2770	3810	1700	1010	1230	1060	2720
MIN	928	1120	1850	1200	1700	1610	1730	908	655	502	509	668
CFSM	.81	.89	1.56	1.21	1.34	1.19	1.47	.80	.50	.42	.47	.76
IN.	.94	.99	1.80	1.39	1.45	1.38	1.64	.93	.55	.49	.54	.84

CAL YR 1987 TOTAL 529343 MEAN 1450 MAX 3920 MIN 585 CFSM .91 IN 12.31
WTR YR 1988 TOTAL 556413 MEAN 1520 MAX 3920 MIN 502 CFSM .95 IN 12.94

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1987 to current year.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV 17...	1200	1170	658	8.1	9.0	3.8	11.7	105	K24	K2
JAN 27...	1430	2160	582	8.2	0.5	3.3	13.6	95	K260	K490
MAR 23...	1100	1610	566	8.6	5.5	1.4	13.7	112	K2	K1
MAY 18...	1200	1460	--	8.5	19.0	5.1	13.2	145	K5	K4
JUL 28...	1500	650	595	8.5	28.5	3.7	12.0	158	28	K20
SEP 21...	1200	1920	--	8.3	18.0	9.2	7.0	75	96	E67

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV 17...	300	70	82	24	25	15	0.6	2.6	286	0
JAN 27...	250	47	67	19	17	13	0.5	2.3	242	0
MAR 23...	270	57	73	22	21	14	0.6	2.0	244	10
MAY 18...	270	54	70	23	24	16	0.7	2.1	249	7
JUL 28...	230	41	52	24	41	28	1	2.7	200	14
SEP 21...	270	62	70	24	34	21	0.9	2.6	259	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV 17...	234	56	36	0.30	8.3	396	0.54	1250	<0.010
JAN 27...	198	51	28	0.20	8.9	327	0.44	1910	0.020
MAR 23...	216	52	30	0.20	6.8	345	0.47	1500	<0.010
MAY 18...	216	54	35	0.30	0.70	345	0.47	1360	0.020
JUL 28...	188	53	50	0.30	0.73	338	0.46	593	0.030
SEP 21...	212	58	47	0.20	2.3	371	0.50	1920	0.020

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
NOV										
17...	1.00	0.230	0.030	1.0	0.040	0.010	<0.010	10	1	68
JAN										
27...	1.40	0.170	0.140	1.2	0.050	0.020	0.010	--	--	--
MAR										
23...	1.20	0.010	0.020	0.60	0.020	0.020	<0.010	10	<1	54
MAY										
18...	0.500	0.050	0.040	0.70	0.040	0.020	<0.010	20	1	70
JUL										
28...	0.660	<0.010	0.020	0.90	0.080	0.010	<0.010	--	--	--
SEP										
21...	0.640	0.260	0.240	1.1	0.070	0.030	0.020	<10	1	72

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
NOV										
17...	<0.5	<1	<1	<3	2	23	<5	6	14	<0.1
JAN										
27...	--	--	--	--	--	--	--	--	--	--
MAR										
23...	<0.5	<1	<1	<3	1	15	<5	15	30	<0.1
MAY										
18...	<0.5	<1	<1	<3	1	7	<5	9	3	<0.1
JUL										
28...	--	--	--	--	--	--	--	--	--	--
SEP										
21...	<0.5	<1	1	<3	2	19	<5	10	8	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV										
17...	<10	<1	<1	<1.0	150	<6	13	17	54	79
JAN										
27...	--	--	--	--	--	--	--	5	29	89
MAR										
23...	<10	5	<1	<1.0	130	<6	6	6	26	80
MAY										
18...	<10	<1	<1	<1.0	140	<6	<3	26	102	90
JUL										
28...	--	--	--	--	--	--	--	17	30	92
SEP										
21...	<10	1	<1	<1.0	130	<6	8	39	202	82

04108600 RABBIT RIVER NEAR HOPKINS, MI

LOCATION.--Lat 42°38'32", long 85°43'19", in SE1/4 sec.16, T.3 N., R.12 W., Allegan County, Hydrologic Unit 04050003, on left bank at downstream side of bridge on 18th Street, 2.5 mi northeast of Hopkins.

DRAINAGE AREA.--71.4 mi².

PERIOD OF RECORD.--October 1965 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 700 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 16, Jan. 25-29, and Feb. 3-14. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 57.5 ft³/s, 10.94 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,180 ft³/s, June 26, 1978, gage height, 9.56 ft; minimum not determined; minimum daily, 9.2 ft³/s, Aug. 27, 28, 1970, Sept. 18, 1971, Aug. 7, 1987; minimum gage height, 1.68 ft, Aug. 8, 1987.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 20	2200	*369	*7.26	Jan. 31	2400	329	6.98
Jan. 18	1800	304	6.77				

Minimum discharge, 9.4 ft³/s, July 15, gage height, 1.71 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	61	91	118	71	300	120	103	53	24	15	14	12
2	59	107	95	67	206	113	87	49	24	15	13	12
3	58	83	78	63	120	101	142	46	26	15	11	13
4	49	70	71	60	95	77	203	44	24	15	11	15
5	45	58	63	57	83	71	133	43	23	14	11	16
6	43	50	58	55	72	69	122	41	22	13	12	15
7	43	46	59	52	68	72	211	40	21	12	11	14
8	41	47	117	50	64	81	137	38	21	11	11	13
9	39	47	155	50	61	102	96	40	22	11	14	13
10	37	44	136	50	60	92	82	52	23	12	14	12
11	36	41	93	50	60	79	75	48	22	13	14	12
12	36	40	99	49	60	78	69	44	21	11	13	12
13	35	39	87	50	62	87	67	42	21	11	12	13
14	35	37	72	52	72	79	68	39	20	11	12	13
15	34	36	71	56	119	74	66	37	20	10	15	12
16	34	36	81	60	139	69	61	37	20	12	14	12
17	35	36	86	120	112	66	58	35	19	20	13	13
18	36	37	79	277	90	67	56	34	19	17	16	14
19	35	38	76	251	83	66	53	33	19	16	18	20
20	47	37	262	235	79	62	51	32	19	15	16	33
21	89	36	321	211	69	58	53	31	18	15	15	32
22	80	35	216	127	76	58	51	32	17	15	14	39
23	74	36	137	95	98	59	74	30	18	15	17	183
24	66	37	152	82	78	60	79	31	17	15	19	141
25	68	65	249	71	69	64	65	30	16	16	17	90
26	59	101	196	65	68	67	59	29	15	17	16	61
27	61	71	128	60	82	61	68	28	15	15	15	46
28	60	60	103	58	85	59	81	27	15	15	15	39
29	55	87	92	60	105	67	67	27	17	14	15	35
30	50	134	79	117	---	157	59	26	16	14	14	32
31	46	---	75	254	---	153	---	25	---	16	13	---
TOTAL	1546	1682	3704	2975	2735	2488	2596	1143	594	436	435	987
MEAN	49.9	56.1	119	96.0	94.3	80.3	86.5	36.9	19.8	14.1	14.0	32.9
MAX	89	134	321	277	300	157	211	53	26	20	19	183
MIN	34	35	58	49	60	58	51	25	15	10	11	12
CFSM	.70	.79	1.67	1.35	1.32	1.13	1.21	.52	.28	.20	.20	.46
IN.	.81	.88	1.93	1.55	1.42	1.30	1.35	.60	.31	.23	.23	.51

CAL YR 1987 TOTAL 18528.8 MEAN 50.8 MAX 321 MIN 9.2 CFSM .71 IN 9.65
WTR YR 1988 TOTAL 21321.0 MEAN 58.3 MAX 321 MIN 10 CFSM .82 IN 11.11

04108800 MACATAWA RIVER NEAR ZEELAND, MI

LOCATION.--Lat 42°46'40", long 86°01'06", in NW1/4 sec.31, T.5 N., R.14 W., Ottawa County, Hydrologic Unit 04050002, on left bank 20 ft upstream from bridge on State Road, 0.2 mi downstream from South Branch, and 2.5 mi south of Zeeland.

DRAINAGE AREA.--65.8 mi².

PERIOD OF RECORD.--October 1960 to current year. Prior to October 1978, published as Black River near Zeeland.

GAGE.--Water-stage recorder. Datum of gage is 585.7 ft above National Geodetic Vertical Datum of 1929 (levels by Gove Associates, Inc.).

REMARKS.--Estimated daily discharges: Dec. 29 to Jan. 20, Jan. 25-28, and Feb. 3-14, 17-28. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--28 years, 67.6 ft³/s, 13.95 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,220 ft³/s, May 11, 1981, gage height, 15.81 ft; minimum, 0.83 ft³/s, Aug. 3, 1988; minimum gage height, 1.61 ft, Sept. 3, 1983.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 20	2300	1,280	10.84	Apr. 7	unknown	*1,320	*10.93

Minimum discharge, 0.83 ft³/s, Aug. 3; gage height, 1.72 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	49	325	250	41	581	249	88	29	5.1	2.7	2.1	2.1
2	64	276	146	39	217	209	69	26	5.3	2.3	1.7	2.0
3	128	158	86	37	80	113	342	24	5.9	2.1	1.3	2.4
4	53	98	81	36	55	53	507	23	5.0	2.0	1.3	2.8
5	36	56	71	34	45	43	153	20	4.7	1.9	1.3	3.4
6	29	40	59	33	40	43	551	19	5.1	1.8	1.5	3.2
7	27	35	87	31	38	48	923	18	4.3	1.8	1.4	3.0
8	29	37	347	29	37	64	272	18	4.1	1.8	1.4	2.8
9	23	40	394	29	36	113	81	18	4.4	1.6	2.7	2.8
10	20	34	218	29	36	60	55	22	4.4	1.7	2.2	2.8
11	19	30	107	29	36	43	45	19	4.1	1.8	2.5	2.9
12	18	29	188	29	37	46	40	17	3.8	1.5	2.1	2.9
13	16	28	99	30	38	56	36	15	3.9	1.6	1.6	3.6
14	15	27	62	31	45	41	41	14	3.4	1.5	1.5	3.4
15	14	25	56	33	193	47	37	15	3.2	1.5	2.3	3.6
16	14	24	65	35	321	51	32	17	3.3	2.3	2.7	3.5
17	15	24	94	410	190	49	29	14	2.9	5.2	2.7	3.7
18	16	24	102	740	130	77	28	13	2.9	3.3	4.0	4.9
19	17	24	98	510	115	63	26	12	2.8	2.8	4.2	6.8
20	32	25	779	600	90	40	26	11	2.8	2.4	4.1	8.8
21	384	24	899	494	60	35	29	11	2.9	2.6	3.4	7.1
22	281	24	403	166	95	33	26	9.5	3.0	2.7	3.1	9.2
23	152	32	203	74	300	33	65	9.1	3.0	2.9	4.4	208
24	111	37	255	57	115	32	46	8.0	3.0	2.4	4.4	88
25	118	279	436	45	53	32	32	7.3	2.8	4.0	3.7	36
26	62	401	192	40	50	54	28	6.9	2.6	3.9	3.1	20
27	119	115	84	37	95	32	97	6.4	2.7	2.8	3.2	14
28	96	72	63	36	130	28	156	5.9	2.9	2.5	3.3	11
29	65	255	55	39	229	82	51	6.0	3.3	2.0	3.1	8.9
30	61	443	47	418	---	579	35	6.1	2.9	2.5	2.7	7.9
31	30	---	44	758	---	334	---	5.5	---	2.6	2.4	---
TOTAL	2103	3041	6070	4949	3487	2782	3946	445.7	110.5	74.5	81.4	481.5
MEAN	67.8	101	196	160	120	89.7	132	14.4	3.68	2.40	2.63	16.1
MAX	384	443	899	758	581	579	923	29	5.9	5.2	4.4	208
MIN	14	24	44	29	36	28	26	5.5	2.6	1.5	1.3	2.0
CFSM	1.03	1.54	2.98	2.43	1.82	1.36	2.01	.22	.06	.04	.04	.25
IN.	1.19	1.72	3.43	2.80	1.97	1.57	2.23	.25	.06	.04	.05	.27

CAL YR 1987 TOTAL 24964.0 MEAN 68.4 MAX 1030 MIN 1.2 CFSM 1.04 IN 14.11
WTR YR 1988 TOTAL 27571.6 MEAN 75.3 MAX 923 MIN 1.3 CFSM 1.14 IN 15.59

04109000 GRAND RIVER AT JACKSON, MI

LOCATION.--Lat 42°17'05", long 84°24'30", in sec.22, T.2 S., R.1 W., Jackson County, Hydrologic Unit 04050004, on left bank on grounds of sewage-treatment plant, 1 mi north of Jackson, 2.2 mi upstream from Portage River, and at mile 216.

DRAINAGE AREA.--174 mi^2.

PERIOD OF RECORD.--April 1935 to current year.

REVISED RECORDS.--WSP 974: 1937(M). WSP 1387: 1936. WSP 1727: 1950(M).

GAGE.--Water-stage recorder. Datum of gage is 900.00 ft, Fargo Engineering Co. datum. Prior to Sept. 24, 1935, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Slight regulation by mills upstream from station. Flow includes about 17 ft^3/s as sewage effluent, which originates from ground-water sources, from the City of Jackson. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--53 years, 122 ft^3/s, 9.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,070 ft^3/s, June 25, 1937, gage height, 13.50 ft; maximum gage height, 15.44 ft, June 25, 1968; minimum discharge, 9.2 ft^3/s, Aug. 22, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 452 ft^3/s, Sept. 22, gage height, 12.15 ft, from graph based on gage readings; minimum, 21 ft^3/s, July 3, 4, gage height, 8.24 ft, result of regulation.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	107	106	172	168	197	123	205	150	55	35	35	38
2	69	98	173	141	196	126	201	149	53	29	39	35
3	57	98	174	164	209	171	213	149	56	27	35	48
4	52	99	172	165	168	179	209	146	47	27	40	50
5	57	94	155	134	150	176	191	140	43	32	63	53
6	58	68	145	144	129	173	253	108	48	37	43	42
7	57	57	151	112	137	135	273	96	47	37	34	40
8	56	53	161	99	155	126	269	88	47	34	34	39
9	57	55	167	93	150	176	270	92	46	31	38	42
10	56	54	162	87	141	181	269	93	46	33	39	35
11	58	54	165	85	129	184	268	88	42	34	42	33
12	57	54	171	87	123	201	263	85	38	34	38	46
13	56	54	171	81	121	201	258	82	43	33	34	46
14	56	50	172	74	118	199	254	77	47	32	31	41
15	56	49	217	74	146	198	244	85	45	31	35	40
16	56	51	202	77	136	196	219	89	45	47	35	39
17	54	58	199	110	173	178	204	83	45	43	36	36
18	50	56	197	113	179	169	198	78	41	36	68	56
19	54	52	179	115	177	164	178	76	37	33	52	75
20	60	52	186	130	174	157	168	74	41	32	41	68
21	65	46	176	172	147	155	160	73	42	30	36	55
22	64	46	192	175	186	154	155	66	46	40	37	111
23	67	53	200	168	180	152	157	67	48	30	67	233
24	81	77	202	163	171	160	142	67	41	30	46	159
25	69	162	198	161	132	171	142	65	37	68	43	153
26	77	133	195	114	121	177	166	63	31	55	40	152
27	135	130	191	149	125	174	169	62	34	42	42	149
28	126	139	190	162	115	184	167	57	35	42	43	146
29	122	150	184	161	119	188	164	54	37	41	38	139
30	120	152	163	174	---	209	156	51	37	38	38	134
31	95	---	186	188	---	210	---	54	---	32	37	---
TOTAL	2204	2400	5568	4040	4404	5347	6185	2707	1300	1125	1279	2333
MEAN	71.1	80.0	180	130	152	172	206	87.3	43.3	36.3	41.3	77.8
MAX	135	162	217	188	209	210	273	150	56	68	68	233
MIN	50	46	145	74	115	123	142	51	31	27	31	33
CFSM	.41	.46	1.03	.75	.87	.99	1.18	.50	.25	.21	.24	.45
IN.	.47	.51	1.19	.86	.94	1.14	1.32	.58	.28	.24	.27	.50

CAL YR 1987 TOTAL 35216 MEAN 96.5 MAX 217 MIN 26 CFSM .56 IN 7.53
WTR YR 1988 TOTAL 38892 MEAN 106 MAX 273 MIN 27 CFSM .61 IN 8.31

04111379 RED CEDAR RIVER NEAR WILLIAMSTON, MI

LOCATION.--Lat 42°40'59", long 84°13'09", in NE1/4 sec.4, T.3 N., R.2 E., Ingham County, Hydrologic Unit 04050004, on right bank 20 ft upstream from bridge on State Highway 52, 1.5 mi upstream from Squaw Creek, and 3.5 mi east of Williamston.

DRAINAGE AREA.--163 mi².

PERIOD OF RECORD.--July 1975 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 870 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30 to Feb. 29. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--13 years, 103 ft³/s, 8.58 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,790 ft³/s, Feb. 26, 1985, gage height, 9.07 ft; minimum, 2.2 ft³/s, July 13, 14, 1988, gage height, 1.94 ft.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1975, reached a stage of 10.41 ft, Apr. 19, and a discharge of 2,640 ft³/s, Apr. 20.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 415 ft³/s, Apr. 9, gage height, 5.81 ft; minimum, 2.2 ft³/s, July 13, 14, gage height, 1.94 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24	52	114	140	250	123	152	99	29	8.3	17	16
2	24	59	111	120	270	131	139	91	28	9.7	14	15
3	23	62	106	110	250	161	136	84	29	9.0	11	16
4	23	59	99	120	200	159	178	79	28	8.3	9.9	16
5	22	55	91	100	170	138	204	74	26	7.9	11	16
6	21	54	85	90	130	129	211	71	24	9.0	20	16
7	21	51	81	85	140	142	348	68	22	8.3	19	16
8	22	50	88	80	150	179	404	65	22	5.8	17	15
9	22	49	131	76	140	246	413	63	21	5.6	15	13
10	21	47	170	72	130	272	402	67	20	5.5	17	12
11	21	45	172	68	110	267	364	63	21	6.9	17	11
12	21	43	165	66	100	268	317	59	19	7.9	17	12
13	21	42	156	64	100	311	271	57	17	4.7	17	13
14	21	41	139	60	100	306	234	54	16	4.4	14	13
15	22	40	144	58	110	288	199	51	15	5.2	20	12
16	26	38	214	56	120	262	171	61	15	5.7	18	12
17	26	38	235	70	130	231	150	70	13	13	17	12
18	27	40	229	160	140	203	136	65	14	12	47	12
19	28	40	216	230	140	188	126	58	13	12	48	17
20	31	39	260	270	130	174	116	56	11	12	37	25
21	34	36	351	290	120	154	111	52	11	12	28	24
22	36	34	342	270	125	135	106	49	11	13	24	24
23	38	35	331	230	160	124	118	46	9.8	12	25	55
24	40	35	318	200	200	125	141	45	9.9	14	26	64
25	43	65	316	110	180	135	136	43	8.9	16	24	54
26	45	123	296	130	160	148	119	40	8.0	25	21	43
27	50	135	262	110	140	149	111	37	9.1	19	19	36
28	55	126	231	100	135	136	110	35	9.1	16	19	31
29	56	116	184	100	125	131	112	33	11	15	19	27
30	52	114	130	100	---	142	108	33	8.7	13	18	25
31	48	---	120	150	---	157	---	32	---	19	17	---
TOTAL	964	1763	5887	3885	4355	5714	5843	1800	499.5	335.2	642.9	673
MEAN	31.1	58.8	190	125	150	184	195	58.1	16.7	10.8	20.7	22.4
MAX	56	135	351	290	270	311	413	99	29	25	48	64
MIN	21	34	81	56	100	123	106	32	8.0	4.4	9.9	11
CFSM	.19	.36	1.17	.77	.92	1.13	1.20	.36	.10	.07	.13	.14
IN.	.22	.40	1.34	.89	.99	1.30	1.33	.41	.11	.08	.15	.15

CAL YR 1987 TOTAL 26051.2 MEAN 71.4 MAX 351 MIN 6.9 CFSM .44 IN 5.95
WTR YR 1988 TOTAL 32361.6 MEAN 88.4 MAX 413 MIN 4.4 CFSM .54 IN 7.39

04111500 DEER CREEK NEAR DANSVILLE, MI

LOCATION.--Lat 42°36'30", long 84°19'15", in E1/2 sec.33, T.3 N., R.1 E., Ingham County, Hydrologic Unit 04050004, on right bank 15 ft upstream from bridge on Clark Road, 3.5 mi north of Dansville, and 7.2 mi upstream from mouth.

DRAINAGE AREA.--16.3 mi^2.

PERIOD OF RECORD.--May 1954 to current year.

REVISED RECORDS.--WSP 1727: 1954(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 889.08 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 16, Jan. 18, 19, 22-28, Feb. 5-13, 21, 26, 28, June 20, 21, and July 31 to Aug. 2. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--34 years, 10.8 ft^3/s, 9.00 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 962 ft^3/s, Apr. 19, 1975, gage height, 12.18 ft, from floodmark, from rating curve extended above 610 ft^3/s; minimum, 0.04 ft^3/s, Sept. 8, 9, 12, 1978, gage height, 2.58 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Apr. 7	0100	*190	*6.26	No other peak greater than base discharge.			

Minimum discharge, 0.17 ft^3/s, July 9, gage height, 2.65 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.8	3.3	11	10	61	16	16	8.2	1.7	.61	.56	.88
2	1.6	4.8	11	9.0	36	19	14	7.7	1.8	.58	.54	.52
3	1.5	4.5	9.6	8.5	28	23	16	7.1	1.8	.56	.43	.56
4	1.4	4.0	8.5	7.8	23	18	27	6.8	1.7	.46	.37	.66
5	1.3	3.3	7.8	7.2	19	14	22	6.4	1.6	.43	.66	.70
6	1.2	3.0	7.3	6.8	17	14	59	6.0	1.5	.41	1.9	.64
7	1.2	2.7	6.9	6.3	15	17	145	5.6	1.3	.42	1.4	.57
8	1.2	2.7	13	5.8	13	22	74	5.4	1.2	.39	.81	.71
9	1.1	2.5	24	5.5	12	32	43	7.5	1.5	.28	.74	.65
10	1.1	2.4	20	5.0	11	24	30	9.2	1.5	.27	.70	.42
11	1.1	2.2	15	4.7	10	21	24	7.2	1.4	.40	.63	.38
12	1.1	2.2	15	4.4	10	27	20	6.3	1.4	.36	.56	.46
13	1.1	2.2	13	4.1	10	36	17	5.8	1.2	.31	.52	.57
14	1.1	2.2	11	3.8	14	24	17	5.0	1.2	.29	.50	.51
15	1.1	2.0	29	3.5	25	21	15	4.9	1.1	.24	1.1	.46
16	1.0	2.0	42	5.7	27	20	14	7.9	.82	.36	1.5	.45
17	1.0	2.1	25	23	22	18	13	6.3	.84	1.0	.93	.45
18	1.1	2.4	19	65	17	21	12	5.2	.79	.62	2.2	.56
19	1.1	2.4	16	42	16	20	10	4.6	.73	.62	3.8	.86
20	1.2	2.3	72	45	14	16	10	4.5	.65	.56	2.2	2.4
21	1.6	2.0	61	35	13	14	9.6	4.2	.58	.60	1.5	3.0
22	2.0	2.0	32	23	15	13	8.8	3.9	.58	.65	1.1	2.4
23	2.2	2.2	24	16	29	13	16	3.6	.56	.90	1.2	21
24	2.4	2.2	24	12	23	14	15	3.4	.52	.73	1.3	18
25	3.2	11	30	9.5	17	16	12	3.1	.49	.71	1.0	10
26	3.3	23	23	8.2	15	16	11	2.9	.43	1.5	.83	6.5
27	4.0	13	19	8.0	14	13	10	2.7	.45	1.1	.73	5.0
28	4.5	10	16	8.0	13	12	11	2.5	.49	.76	.79	4.1
29	3.7	10	15	8.6	13	14	11	2.4	.54	.61	.70	3.5
30	3.2	12	13	17	---	19	9.1	2.0	.63	.55	.90	3.1
31	2.8	---	11	46	---	19	---	1.9	---	.54	.79	---
TOTAL	57.2	142.6	644.1	464.4	552	586	711.5	160.2	31.00	17.82	32.91	90.01
MEAN	1.85	4.75	20.8	15.0	19.0	18.9	23.7	5.17	1.03	.57	1.06	3.00
MAX	4.5	23	72	65	61	36	145	9.2	1.8	1.5	3.8	21
MIN	1.0	2.0	6.9	3.5	10	12	8.8	1.9	.43	.24	.37	.38
CFSM	.11	.29	1.28	.92	1.17	1.16	1.45	.32	.06	.04	.07	.18
IN.	.13	.33	1.47	1.06	1.26	1.34	1.62	.37	.07	.04	.08	.21

CAL YR 1987	TOTAL	2469.98	MEAN 6.77	MAX 72	MIN .14	CFSM .42	IN 5.64
WTR YR 1988	TOTAL	3489.74	MEAN 9.53	MAX 145	MIN .24	CFSM .59	IN 7.96

04112000 SLOAN CREEK NEAR WILLIAMSTON, MI

LOCATION.--Lat 42°40'33", long 84°21'50", in SE1/4 NE1/4 sec.1, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, on left bank 30 ft downstream from culvert on Meridian Road, 2.1 mi upstream from mouth, and 4.2 mi west of Williamston.

DRAINAGE AREA.--9.34 mi².

PERIOD OF RECORD.--June 1954 to current year.

GAGE.--Water-stage recorder and concrete control with V-notch sharp-crested weir. Datum of gage is 862.12 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Oct. 1-5, 17-20, 23-25, Dec. 31 to Jan. 15, Jan. 23-28, Feb. 6-13, Feb. 23 to Mar. 1, June 14-19, June 25 to July 4, July 15-17, and Sept. 16, 23-25. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--34 years, 5.72 ft³/s, 8.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,290 ft³/s, Apr. 18, 1975, gage height, 9.99 ft, from rating curve extended above 560 ft³/s on basis of computation of peak flow through culvert and over road embankment; minimum, 0.01 ft³/s, Sept. 11, 1954, Jan. 18, 1957, Aug. 3, 1988; minimum gage height, 1.10 ft, Sept. 11, 1954, Jan. 18, 1957.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Apr. 6	2200	*178	*4.39	No other peak greater than base discharge.			

Minimum discharge, 0.01 ft³/s, Aug. 3, gage height, 1.14 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.25	.78	3.5	4.0	30	6.2	5.6	2.7	.46	.10	.04	.06
2	.22	1.2	3.5	3.5	19	10	5.1	2.5	.48	.08	.03	.05
3	.18	.84	3.1	3.0	13	12	10	2.4	.50	.07	.02	.07
4	.17	.70	2.8	2.7	9.2	7.2	33	2.3	.46	.06	.02	.08
5	.16	.60	2.5	2.4	7.4	5.7	17	2.2	.39	.05	.05	.10
6	.15	.57	2.4	2.2	6.5	6.0	53	2.0	.35	.05	.06	.08
7	.17	.55	2.3	1.9	5.0	7.8	78	1.9	.33	.06	.03	.07
8	.16	.55	6.0	1.8	4.5	13	36	1.9	.31	.06	.03	.05
9	.15	.54	13	1.7	4.2	21	25	1.9	.33	.07	.03	.04
10	.16	.48	8.7	1.6	3.8	14	18	2.7	.31	.09	.05	.04
11	.15	.46	6.0	1.6	3.6	9.2	13	2.3	.30	.08	.04	.04
12	.15	.47	7.1	1.5	3.5	17	8.7	2.0	.26	.12	.04	.04
13	.15	.46	5.7	1.4	3.4	23	7.3	1.8	.26	.11	.04	.05
14	.15	.42	4.5	1.3	3.4	14	6.8	1.6	.23	.12	.05	.05
15	.16	.34	16	1.2	5.8	9.6	6.0	1.6	.21	.10	.15	.04
16	.19	.34	19	1.8	7.1	8.1	5.2	1.8	.21	.09	.10	.04
17	.19	.39	10	15	6.1	7.2	4.8	1.6	.19	.15	.10	.04
18	.21	.39	7.1	33	5.7	7.8	4.4	1.4	.17	.07	.52	.05
19	.23	.35	6.6	20	6.0	7.3	3.8	1.4	.15	.08	.25	.08
20	.50	.33	47	24	5.3	6.1	3.6	1.3	.14	.06	.19	.15
21	.39	.30	28	16	4.6	5.1	3.5	1.2	.15	.07	.16	.10
22	.44	.29	17	8.8	7.3	4.6	3.1	1.2	.17	.07	.18	.13
23	.43	.34	11	6.0	16	4.7	4.8	1.1	.20	.06	.28	2.5
24	.35	.34	15	4.5	9.4	4.6	4.8	1.0	.18	.06	.31	1.4
25	.43	4.0	19	3.5	6.4	5.0	4.0	.87	.14	.08	.28	.66
26	.35	5.1	13	3.0	5.7	5.2	3.7	.80	.13	.08	.27	.37
27	.64	3.2	8.4	2.8	5.3	4.5	3.5	.73	.12	.05	.27	.25
28	.65	2.5	6.9	2.8	4.8	4.0	3.3	.66	.11	.05	.28	.18
29	.50	2.7	5.8	3.1	5.3	4.2	3.0	.61	.12	.03	.23	.16
30	.44	3.3	5.0	7.5	---	5.9	2.8	.57	.13	.04	.22	.15
31	.39	---	4.5	25	---	6.4	---	.55	---	.04	.16	---
TOTAL	8.86	32.83	310.4	208.6	217.3	266.4	380.8	48.59	7.49	2.30	4.48	7.12
MEAN	.29	1.09	10.0	6.73	7.49	8.59	12.7	1.57	.25	.074	.14	.24
MAX	.65	5.1	47	33	30	23	78	2.7	.50	.15	.52	2.5
MIN	.15	.29	2.3	1.2	3.4	4.0	2.8	.55	.11	.03	.02	.04
CFSM	.03	.12	1.07	.72	.80	.92	1.36	.17	.03	.008	.02	.03
IN.	.04	.13	1.24	.83	.87	1.06	1.52	.19	.03	.01	.02	.03

CAL YR 1987 TOTAL 1115.53 MEAN 3.06 MAX 47 MIN .04 CFSM .33 IN 4.44
WTR YR 1988 TOTAL 1495.17 MEAN 4.09 MAX 78 MIN .02 CFSM .44 IN 5.95

04112500 RED CEDAR RIVER AT EAST LANSING, MI

LOCATION.--Lat 42°43'40", long 84°28'40", in SW1/4 sec.18, T.4 N., R.1 W., Ingham County, Hydrologic Unit 04050004, in left downstream bridge abutment of Farm Lane Bridge on Michigan State University Campus in East Lansing, 4.0 mi upstream from Sycamore Creek, and 5.6 mi upstream from mouth.

DRAINAGE AREA.--355 mi².

PERIOD OF RECORD.--August 1902 to December 1903, March 1931 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as Red Cedar River at Agricultural College, August 1902 to December 1903 and as Cedar River at East Lansing, March 1931 to September 1965. Gage-height records collected in this vicinity 1911-19, and 1920-28 (flood seasons only), are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1307: 1936(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 824.39 ft above National Geodetic Vertical Datum of 1929. August 1902 to December 1903 nonrecording gage at site 0.8 mi downstream at different datum. March 1931 to November 1940 water-stage recorder at site 250 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Mar. 6-8, 12, 13, 29-31. Records good except for estimated daily discharges, which are fair. Prior to April 1975, occasional regulation at low flow by mill at Williamston, 16 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--58 years, 207 ft³/s, 7.92 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,940 ft³/s, Apr. 20, 1975, gage height, 11.95 ft; minimum, 3 ft³/s, July 31, 1931.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Mar. 24, 1904, reached a stage of 13.4 ft, discharge, 8,000 ft³/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,190 ft³/s, Apr. 8, gage height, 5.81 ft; minimum, 11 ft³/s, July 15, 16; gage height, 3.04 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	48	110	200	270	591	259	290	200	59	20	26	32
2	46	107	204	197	611	290	274	191	57	20	26	28
3	46	110	157	197	520	343	306	178	55	18	22	36
4	42	110	234	217	451	326	429	168	55	18	17	40
5	42	102	168	165	343	290	460	162	53	17	26	40
6	40	96	159	162	237	260	539	156	50	16	30	32
7	40	90	153	159	251	250	1080	153	46	16	34	30
8	44	88	168	146	290	320	1180	150	42	15	36	30
9	46	88	263	140	278	474	1070	150	40	15	32	28
10	44	85	326	131	233	506	897	156	40	15	28	26
11	44	82	314	122	210	460	742	153	40	15	28	24
12	42	80	298	119	188	470	601	143	38	15	30	30
13	44	80	282	119	188	575	501	137	38	15	32	24
14	44	77	255	116	181	586	438	137	34	14	36	24
15	46	77	282	104	194	515	385	134	30	12	66	22
16	48	74	415	104	230	456	339	146	30	21	48	20
17	46	77	433	143	255	411	298	156	30	48	40	20
18	42	80	402	351	255	381	270	156	30	32	102	26
19	48	80	364	469	255	364	248	150	30	32	93	32
20	67	80	539	515	251	339	230	137	30	24	82	69
21	74	77	711	548	214	306	223	128	26	24	64	50
22	72	69	711	487	223	267	210	113	24	22	50	59
23	69	67	631	411	310	248	259	99	24	22	64	150
24	80	67	567	351	376	244	278	93	24	26	57	140
25	82	162	567	290	343	259	270	88	22	34	53	131
26	82	223	543	227	282	274	244	85	20	34	46	99
27	107	240	474	181	270	267	223	80	19	36	42	80
28	110	217	407	184	240	251	223	74	17	36	38	69
29	116	207	347	181	248	244	220	72	18	28	34	62
30	107	204	214	200	---	278	217	64	18	24	32	57
31	99	---	259	339	---	298	---	59	---	24	32	---
TOTAL	1907	3306	11047	7345	8518	10811	12944	4068	1038	708	1346	1510
MEAN	61.5	110	356	237	294	349	431	131	34.6	22.8	43.4	50.3
MAX	116	240	711	548	611	586	1180	200	59	48	102	150
MIN	40	67	153	104	181	244	210	59	17	12	17	20
CFSM	.17	.31	1.00	.67	.83	.98	1.21	.37	.10	.06	.12	.14
IN.	.20	.35	1.16	.77	.89	1.13	1.36	.43	.11	.07	.14	.16

CAL YR 1987 TOTAL 51524 MEAN 142 MAX 711 MIN 17 CFSM .40 IN 5.44
WTR YR 1988 TOTAL 64548 MEAN 176 MAX 1180 MIN 12 CFSM .50 IN 6.76

04113000 GRAND RIVER AT LANSING, MI

LOCATION.--Lat 42°45'02", long 84°33'19", in NW1/4 sec.9, T.4 N., R.2 W., Ingham County, Hydrologic Unit 04050004, on right bank 30 ft upstream from bridge on North Grand River Avenue in Lansing, 2.0 mi downstream from Red Cedar River, and at mile 152.

DRAINAGE AREA.--1,230 mi^2, approximately.

PERIOD OF RECORD.--March 1901 to September 1906, October 1934 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "at North Lansing" 1901-6. Gage-height records collected in this vicinity 1907-10 (flood seasons only), 1911-19, 1920-28 (flood seasons only), and since 1931 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1174: 1949. WSP 1387: 1901, 1903-4, 1935, 1937, 1942.

GAGE.--Water-stage recorder. Datum of gage is 805.53 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to August 1906, nonrecording gage at same site at different datum. November 1934 to June 1949 water-stage recorder at site 1.8 mi downstream at datum 2.42 ft lower.

REMARKS.--No estimated daily discharges. Records good. Large diurnal fluctuation at low and medium flow caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--59 years, 840 ft^3/s, 9.27 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 24,500 ft^3/s, Mar. 26, 1904, gage height, 18.60 ft, datum then in use, from rating curve extended above 15,000 ft^3/s; minimum, 2.8 ft^3/s, Sept. 9, 1963, gage height, 0.85 ft; minimum daily, 20 ft^3/s, Aug. 25, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1901, that of Mar. 26, 1904.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,060 ft^3/s, Apr. 8, gage height, 8.71 ft; minimum daily, 84 ft^3/s, July 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	293	616	953	1110	1950	1010	1370	757	197	115	148	135
2	447	560	943	851	2050	1100	1300	838	242	120	153	146
3	346	621	923	942	1710	1110	1460	733	284	113	118	310
4	365	599	959	1030	1600	1160	1740	682	278	122	118	172
5	272	489	779	726	1420	1070	1790	708	261	141	194	224
6	254	548	928	817	918	1060	2350	659	198	106	220	221
7	283	460	833	717	965	1010	3570	619	255	104	319	390
8	269	532	886	732	1080	1150	3680	609	153	105	255	106
9	343	471	1150	694	1100	1370	3300	617	221	94	192	183
10	261	369	1300	720	1050	1460	2900	403	223	134	183	158
11	213	470	1240	669	1010	1430	2460	633	174	88	189	154
12	252	252	1320	614	967	1510	2040	525	189	92	139	154
13	342	483	1140	659	956	1580	1850	528	182	91	194	175
14	261	340	1150	518	903	1720	1700	460	187	87	193	158
15	236	267	1290	486	987	1580	1570	519	162	84	309	125
16	239	358	1630	515	975	1530	1480	539	142	124	163	180
17	280	420	1640	689	1070	1420	1310	526	201	277	208	138
18	265	390	1610	1110	1090	1360	1320	618	177	161	521	194
19	238	380	1590	1460	1100	1360	1230	525	134	264	282	277
20	340	303	2210	1570	1090	1270	1140	425	197	199	293	482
21	327	417	2390	1580	953	1210	1120	454	129	125	248	285
22	337	368	2320	1480	1040	1180	1010	449	116	119	238	458
23	365	301	2160	1390	1060	1080	1170	403	138	173	293	907
24	409	326	2070	1280	1310	1070	1260	407	118	124	257	810
25	398	838	1920	1120	1200	1200	1030	433	127	234	172	826
26	354	813	1850	960	1120	1150	1020	299	127	262	243	741
27	520	995	1740	877	1090	1150	875	372	204	231	244	710
28	510	992	1510	807	1080	1150	979	339	113	295	141	586
29	513	994	1440	780	1060	1160	762	344	115	198	182	579
30	539	1000	914	931	---	1290	925	294	115	156	150	472
31	547	---	1170	1410	---	1360	---	344	---	181	230	---
TOTAL	10618	15972	43958	29244	33904	39260	49711	16061	5359	4719	6789	10456
MEAN	343	532	1418	943	1169	1266	1657	518	179	152	219	349
MAX	547	1000	2390	1580	2050	1720	3680	838	284	295	521	907
MIN	213	252	779	486	903	1010	762	294	113	84	118	106
CFSM	.28	.43	1.15	.77	.95	1.03	1.35	.42	.15	.12	.18	.28
IN.	.32	.48	1.33	.88	1.03	1.19	1.50	.49	.16	.14	.21	.32

CAL YR 1987 TOTAL 219868 MEAN 602 MAX 2390 MIN 83 CFSM .49 IN 6.[illegible]
WTR YR 1988 TOTAL 266051 MEAN 727 MAX 3680 MIN 84 CFSM .59 IN 8.0[illegible]

04114000 GRAND RIVER AT PORTLAND, MI

LOCATION (REVISED).--Lat 42°51'23", long 84°54'44", in NW1/4 sec.4, T.5 N., R.5 W., Ionia County, Hydrologic Unit 04050004, on left bank at downstream side of bridge on Kent Street, 1.0 mi south of Portland, 1.9 mi upstream from Looking Glass River, and at mile 115.

DRAINAGE AREA.--1,385 mi^2.

PERIOD OF RECORD.--August 1952 to March 1982, June to September 1988. Gage-height records collected in this vicinity 1907-28 (flood seasons only) are contained in reports of the National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 705.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 6, 1953, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Slight diurnal fluctuation caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--29 years (water years 1953-81), 909 ft^3/s, 8.91 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,400 ft^3/s, Apr. 21, 1975, gage height, 12.98 ft; minimum, 38 ft^3/s, Oct. 10, 1963; minimum daily, 58 ft^3/s, Oct. 9, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period June to September, 2,450 ft^3/s, Sept. 23, gage height, 7.50 ft; minimum daily, 142 ft^3/s, July 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1									420	177	221	237
2									300	179	171	215
3									334	176	221	308
4									362	163	174	560
5									347	165	177	338
6									300	196	235	339
7									318	168	279	257
8									303	162	326	413
9									253	158	388	220
10									259	155	304	197
11									315	173	229	207
12									246	153	240	244
13									225	147	212	272
14									278	148	241	273
15									227	142	283	235
16									263	153	362	190
17									210	298	216	227
18									230	361	470	203
19									271	233	588	251
20									204	348	350	631
21									269	257	341	606
22									198	215	283	440
23									202	186	325	1620
24									202	209	377	1190
25									185	209	301	1110
26									186	285	241	1000
27									183	313	270	871
28									254	265	286	817
29									203	333	218	684
30									179	259	196	659
31									---	233	225	---
TOTAL									7726	6619	8750	14814
MEAN									258	214	282	494
MAX									420	361	588	1620
MIN									179	142	171	190
CFSM									.19	.16	.20	.36
IN.									.21	.18	.24	.40

04114500 LOOKING GLASS RIVER NEAR EAGLE, MI

LOCATION.--Lat 42°49'45", long 84°46'40", in sec.10, T.5 N., R.4 W., Clinton County, Hydrologic Unit 04050004, on right bank at upstream side of former bridge site on Hinman Road, 1.5 mi northeast of Eagle, and 10 mi upstream from mouth.

DRAINAGE AREA.--281 mi².

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1387: 1946-47.

GAGE.--Water-stage recorder. Datum of gage is 747.09 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to June 2, 1962, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 29 to Mar. 5. Records good except for estimated daily discharges, which are poor. Small intermittent diversion at times into Lake Geneva when discharge is above 50 ft³/s. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 176 ft³/s, 8.51 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,860 ft³/s, Apr. 5, 1947, gage height, 7.70 ft, from graph based on gage readings, from rating curve extended above 1,900 ft³/s; maximum gage height, 9.9 ft, Mar. 7, 1956, from floodmark, backwater from ice; minimum discharge, 10 ft³/s, July 28, 1965, gage height, 1.01 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,500 ft³/s, Apr. 6, gage height, 5.72 ft; minimum, 23 ft³/s, July 13, 14, 15, gage height, 1.22 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	90	114	277	370	300	190	294	232	61	33	31	34
2	79	153	271	300	285	185	283	220	59	33	29	33
3	73	131	256	250	270	185	297	207	57	32	28	102
4	67	124	248	225	250	185	373	195	56	30	27	91
5	64	117	236	200	230	185	356	181	54	28	29	77
6	62	112	224	180	210	195	595	170	53	29	31	58
7	59	107	215	170	220	211	1140	159	51	28	30	49
8	57	104	266	160	225	240	823	149	49	27	29	43
9	55	100	360	150	235	336	660	143	51	28	56	40
10	52	95	331	140	225	329	614	138	49	26	37	37
11	52	91	276	135	215	333	605	133	47	28	32	35
12	54	87	284	130	210	376	603	132	47	25	31	45
13	53	84	279	125	200	445	599	130	45	25	30	48
14	51	82	271	120	210	427	589	125	44	25	29	38
15	51	80	286	115	220	425	558	121	42	24	44	34
16	49	78	315	110	225	423	516	122	42	26	46	34
17	50	78	306	190	235	413	469	117	41	40	45	34
18	51	79	282	290	240	426	423	113	41	42	100	34
19	49	77	277	335	235	417	380	111	40	42	80	41
20	53	76	627	350	220	390	347	109	39	38	63	108
21	61	74	602	330	225	360	320	105	36	39	49	87
22	67	73	476	310	250	334	290	101	36	36	44	76
23	75	75	421	290	260	317	313	97	37	34	50	424
24	82	75	496	260	250	300	309	92	35	36	53	260
25	97	166	607	240	240	296	274	86	34	38	51	154
26	97	266	542	210	220	291	264	82	34	37	44	121
27	104	208	498	190	205	270	262	79	34	35	41	113
28	109	196	478	170	200	260	265	75	33	34	41	110
29	101	249	450	180	195	265	257	72	34	32	38	106
30	95	286	455	210	---	331	245	68	35	32	37	99
31	91	---	460	240	---	323	---	64	---	33	35	---
TOTAL	2150	3637	11372	6675	6705	9663	13323	3928	1316	995	1310	2565
MEAN	69.4	121	367	215	231	312	444	127	43.9	32.1	42.3	85.5
MAX	109	286	627	370	300	445	1140	232	61	42	100	424
MIN	49	73	215	110	195	185	245	64	33	24	27	33
CFSM	.25	.43	1.31	.77	.82	1.11	1.58	.45	.16	.11	.15	.30
IN.	.28	.48	1.51	.88	.89	1.28	1.76	.52	.17	.13	.17	.34

CAL YR 1987 TOTAL 50138 MEAN 137 MAX 627 MIN 30 CFSM .49 IN 6.64
WTR YR 1988 TOTAL 63639 MEAN 174 MAX 1140 MIN 24 CFSM .62 IN 8.42

04115000 MAPLE RIVER AT MAPLE RAPIDS, MI

LOCATION.--Lat 43°06'35", long 84°41'35", in sec.5, T.8 N., R.3 W., Clinton County, Hydrologic Unit 04050005, on right bank at downstream side of bridge on Maple Road in Maple Rapids, 50 ft upstream from Pine Creek, and 0.8 mi upstream from Hayworth Creek. Records include flow of Pine Creek.

DRAINAGE AREA.--434 mi².

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1707: 1956.

GAGE.--Water-stage recorder. Datum of gage is 642.58 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 4, 1968, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 30 to Mar. 6, Mar. 13-17, 29-31, June 9-22, and July 7-16. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 266 ft³/s, 8.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,770 ft³/s, Sept. 12, 1986, gage height, 12.33 ft, from floodmark, caused by dam failure on Rainbow Lake (Pine Creek); minimum, 4.4 ft³/s, Aug. 13, 1965, gage height, 1.62 ft.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in March 1904 reached a stage of 13.8 ft, from information by local resident.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,720 ft³/s, Apr. 8, gage height, 8.61 ft; minimum daily, 8.7 ft³/s, July 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	67	117	447	550	250	300	587	300	44	14	30	17
2	69	133	472	350	380	320	583	276	43	13	30	16
3	67	158	480	260	370	310	577	254	41	12	25	16
4	58	171	469	220	320	300	664	235	40	12	20	19
5	54	169	446	200	270	290	739	214	40	11	17	23
6	53	148	419	160	240	270	811	196	38	11	19	23
7	51	138	396	140	280	265	1290	175	37	10	21	24
8	47	129	391	120	290	272	1670	155	34	10	19	23
9	42	120	446	110	290	345	1680	139	33	9.8	19	21
10	45	111	545	100	280	392	1490	139	35	9.5	19	19
11	42	102	588	90	250	363	1280	135	32	9.3	17	17
12	42	96	607	80	210	339	1090	125	30	9.1	17	16
13	41	92	615	72	210	270	925	117	29	9.0	18	17
14	40	90	597	65	210	250	808	109	28	8.8	14	19
15	40	86	582	60	220	240	711	98	26	8.7	13	19
16	39	81	548	52	240	260	630	98	25	11	12	19
17	39	76	515	50	270	280	559	94	24	22	12	17
18	41	76	482	90	280	339	510	89	23	39	22	21
19	43	75	459	150	280	361	456	84	22	41	29	27
20	46	88	530	230	260	375	408	80	21	32	27	38
21	53	82	793	290	250	378	379	77	20	24	25	40
22	60	75	1010	280	260	432	351	77	19	24	22	38
23	69	70	1110	270	300	502	356	75	22	27	23	229
24	84	72	1120	250	340	519	396	70	20	30	24	275
25	99	97	1230	230	320	526	401	63	17	28	24	265
26	111	229	1330	150	300	506	398	58	18	29	25	241
27	121	270	1270	85	280	497	384	56	15	42	23	210
28	135	306	1150	85	260	503	367	54	13	40	21	178
29	139	338	1000	85	280	510	345	50	14	30	19	132
30	132	389	840	88	---	540	324	48	15	25	19	96
31	124	---	760	140	---	560	---	46	---	25	18	---
TOTAL	2093	4184	21647	5102	7990	11614	21169	3786	818	626.2	643	2115
MEAN	67.5	139	698	165	276	375	706	122	27.3	20.2	20.7	70.5
MAX	139	389	1330	550	380	560	1680	300	44	42	30	275
MIN	39	70	391	50	210	240	324	46	13	8.7	12	16
CFSM	.16	.32	1.61	.38	.64	.86	1.63	.28	.06	.05	.05	.16
IN.	.18	.36	1.86	.44	.68	1.00	1.81	.32	.07	.05	.06	.18

CAL YR 1987 TOTAL 64628.0 MEAN 177 MAX 1330 MIN 15 CFSM .41 IN 5.54
WTR YR 1988 TOTAL 81787.2 MEAN 223 MAX 1680 MIN 8.7 CFSM .51 IN 7.01

04115265 FISH CREEK NEAR CRYSTAL, MI

LOCATION.--Lat 43°14'59", long 84°58'52", in NW1/4 NE1/4 sec.23, T.10 N., R.6 W., Montcalm County, Hydrologic Unit 04050005, on left bank 10 ft downstream from bridge on Sidney Road, 3.5 mi southwest of Crystal.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--October 1987 to September 1988.

GAGE.--Water-stage recorder. Elevation of gage is 795 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 31 to Jan. 6, Jan. 9, 12, 13, 27, and Feb. 2-15. Records good except those for the summer months, which are fair. Several measurements of water temperature were made during the year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 151 ft³/s, Feb. 1, gage height, 4.94 ft; minimum, 7.0 ft³/s, July 10, 14, gage height, 2.27 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	34	55	29	140	31	52	34	20	12	12	14
2	28	39	46	28	60	30	46	37	19	12	12	14
3	29	35	39	27	44	30	83	33	20	12	12	19
4	26	32	36	26	38	28	101	31	19	12	12	19
5	25	31	34	26	34	28	68	30	19	9.3	12	20
6	25	29	32	26	33	30	58	29	19	9.4	12	18
7	25	29	31	26	32	34	62	28	18	9.3	11	17
8	25	30	37	26	31	44	46	27	17	9.6	12	16
9	25	31	56	26	31	80	40	29	18	8.1	21	16
10	24	29	51	26	30	51	38	33	17	9.8	20	15
11	24	28	40	26	30	44	36	31	16	14	17	15
12	24	36	45	27	30	56	34	29	16	12	15	17
13	24	32	40	27	30	68	33	28	16	10	14	19
14	24	30	36	25	30	43	37	27	15	9.1	13	17
15	24	27	33	26	30	37	36	26	14	9.6	13	15
16	24	26	40	27	31	35	35	27	13	15	13	15
17	24	26	38	31	31	33	32	27	14	21	12	16
18	25	27	36	38	31	35	31	26	14	17	27	16
19	26	27	36	35	30	34	30	24	13	16	21	22
20	35	26	61	39	30	32	32	25	12	15	17	49
21	36	25	64	39	30	31	36	26	12	14	17	30
22	32	25	47	35	29	30	32	26	14	15	15	28
23	35	27	41	32	31	31	73	25	15	15	21	66
24	35	28	40	31	29	38	67	24	14	18	21	37
25	36	34	58	30	27	47	44	23	12	17	18	27
26	31	44	53	30	26	54	38	22	11	17	16	24
27	36	41	40	30	26	42	39	22	12	14	16	22
28	34	41	37	31	28	36	42	21	13	12	16	21
29	30	57	34	29	30	40	37	22	15	10	15	20
30	29	65	31	39	---	86	35	21	12	12	15	20
31	28	---	30	121	---	84	---	20	---	14	15	---
TOTAL	874	991	1297	1014	1032	1322	1373	833	459	400.2	483	664
MEAN	28.2	33.0	41.8	32.7	35.6	42.6	45.8	26.9	15.3	12.9	15.6	22.1
MAX	36	65	64	121	140	86	101	37	20	21	27	66
MIN	24	25	30	25	26	28	30	20	11	8.1	11	14

WTR YR 1988 TOTAL 10742.2 MEAN 29.4 MAX 140 MIN 8.1

04116000 GRAND RIVER AT IONIA, MI

LOCATION.--Lat 42°58'20", long 85°04'13", in NW1/4 sec.30, T.7 N., R.6 W., Ionia County, Hydrologic Unit 04050006, on left bank 15 ft downstream from bridge on State Highway 66 in Ionia, 2.7 mi downstream from Prairie Creek, and at mile 87.

DRAINAGE AREA.--2,840 mi², approximately.

PERIOD OF RECORD.--March to June 1931, July and September 1931 (fragmentary), July 1951 to current year. Gage-height records collected in this vicinity 1907-28 (flood seasons only) are contained in reports of the National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 615.38 ft above National Geodetic Vertical Datum of 1929. Mar. 19 to Sept. 24, 1931, nonrecording gage at site 1.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Jan. 4 to Feb. 21. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation below about 5,000 ft³/s caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--37 years (water years 1952-88), 1,950 ft³/s, 9.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 21,500 ft³/s, Apr. 1, 1960, gage height, 23.43 ft; minimum, 40 ft³/s, May 13, 1968, gage height, 5.61 ft; minimum daily, 109 ft³/s, July 16, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,340 ft³/s, Apr. 8, gage height, 18.56 ft; minimum, 249 ft³/s, July 16, gage height, 6.83 ft; minimum daily, 269 ft³/s, July 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1040	1310	3260	3310	4000	2350	3810	2230	814	344	380	406
2	1040	1670	2910	3050	5100	2290	3480	2060	574	311	408	417
3	938	1560	2860	2730	4700	2420	3510	1970	777	328	361	528
4	936	1580	2860	2300	4200	2350	4130	1890	558	304	369	846
5	872	1610	2500	2150	3600	2330	4540	1730	540	286	447	860
6	855	1390	2570	2000	2900	2450	4510	1650	525	333	369	539
7	826	1310	2140	1900	2400	2230	6820	1660	702	297	303	717
8	759	1250	2490	1850	2300	2460	9160	1550	692	306	315	419
9	743	1230	3310	1800	2600	2810	9100	1390	503	311	486	524
10	616	1090	3770	1750	2700	3510	8110	1590	511	278	725	505
11	608	1030	3840	1650	2600	3550	7120	1350	399	298	451	413
12	715	1010	3530	1550	2500	3490	6250	1330	345	289	477	433
13	720	1090	3480	1500	2450	4020	5460	1270	408	300	409	506
14	576	897	3400	1450	2350	4180	4810	1320	481	300	335	478
15	710	978	3170	1400	2400	4070	4380	1140	428	269	346	460
16	733	912	3300	1350	2500	3870	3980	1120	492	271	568	465
17	618	896	3570	1250	2600	3610	3810	1300	462	357	470	416
18	620	885	3530	2400	2700	3540	3440	1080	448	506	632	402
19	603	873	3390	3200	2800	3420	3090	1230	351	716	1260	504
20	769	880	4060	3900	2750	3290	2990	1220	397	413	796	663
21	819	877	6260	4000	2500	3130	2950	980	345	618	505	1310
22	863	858	6620	3900	2640	2990	2630	948	359	360	525	1010
23	940	833	6210	3700	3000	2670	2680	975	411	350	567	2970
24	1070	868	5780	3400	3060	2680	2920	989	383	385	803	4140
25	1130	1150	6230	3100	2930	2690	2900	929	329	483	545	2790
26	1240	2330	6660	2700	2790	2760	2910	894	303	515	516	2270
27	1170	2690	6130	2400	2470	2770	2530	883	294	417	498	1980
28	1290	2190	5490	2150	2380	2700	2430	870	309	443	497	1800
29	1240	2490	4950	1950	2380	2700	2400	839	392	494	499	1560
30	1260	2970	4250	2100	---	3170	2390	605	377	470	474	1360
31	1230	---	3810	2800	---	3720	---	589	---	566	447	---
TOTAL	27549	40707	126330	74690	84300	94220	129240	39581	13909	11918	15783	31691
MEAN	889	1357	4075	2409	[illegible]	3039	4308	1277	464	384	509	1056
MAX	1290	2970	6660	4000	5100	4180	9160	2230	814	716	1260	4140
MIN	576	833	2140	1250	2300	2230	2390	589	294	269	303	402
CFSM	.31	.48	1.44	.85	1.02	1.07	1.52	.45	.16	.14	.18	.37
IN.	.36	.53	1.65	.98	1.10	1.23	1.69	.52	.18	.16	.21	.42

CAL YR 1987 TOTAL 549010 MEAN 1504 MAX 6660 MIN 319 CFSM .53 IN 7.19
WTR YR 1988 TOTAL 689918 MEAN 1885 MAX 9160 MIN 269 CFSM .66 IN 9.04

04117500 THORNAPPLE RIVER NEAR HASTINGS, MI

LOCATION.--Lat 42°36'57", long 85°14'11", in SE1/4 sec.27, T.3 N., R.8 W., Barry County, Hydrologic Unit 04050007, on right bank at downstream side of bridge on McKeown Road, 0.6 mi downstream from Cedar Creek, 2.0 mi downstream from Thornapple Lake, and 3.2 mi southeast of Hastings.

DRAINAGE AREA.--385 mi².

PERIOD OF RECORD.--October 1944 to current year.

GAGE.--Water-stage recorder. Datum of gage is 786.71 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 1, 1965, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--44 years, 320 ft³/s, 11.29 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,810 ft³/s, Apr. 7, 1947, gage height, 10.20 ft, from graph based on gage readings; minimum, 33 ft³/s, Aug. 10, 1964; minimum gage height, 2.71 ft, Aug. 10, 1964, July 14, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,700 ft³/s, Apr. 9, gage height, 6.15 ft; minimum, 47 ft³/s, July 14, gage height, 2.71 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	214	224	524	543	806	418	643	306	128	68	75	75
2	217	245	550	456	957	452	634	286	126	67	71	71
3	214	271	536	390	934	498	596	270	124	66	69	76
4	203	280	495	377	901	502	603	256	119	64	69	105
5	192	265	446	329	825	460	644	246	117	63	72	133
6	185	245	402	285	649	417	691	239	114	62	83	130
7	177	228	369	272	522	402	947	232	111	62	84	119
8	174	216	372	266	446	422	1310	224	110	59	79	108
9	167	205	439	268	426	503	1620	218	102	57	97	98
10	163	197	563	260	403	584	1670	234	100	56	106	91
11	159	190	632	250	373	613	1470	237	98	57	105	84
12	155	185	653	244	337	588	1220	226	97	58	99	82
13	152	181	644	244	328	572	968	218	95	53	92	95
14	149	178	604	236	321	575	769	209	94	50	85	111
15	148	175	574	225	338	551	628	199	93	53	82	111
16	147	171	554	219	398	499	532	215	91	53	80	104
17	147	168	569	242	450	450	460	220	87	68	74	95
18	152	168	587	424	473	418	418	209	85	73	87	105
19	153	171	584	670	468	400	381	196	84	78	96	145
20	163	169	655	866	452	388	351	187	83	81	102	213
21	190	162	890	986	402	368	337	180	83	80	99	277
22	214	156	1080	1010	381	344	326	176	81	80	93	329
23	223	155	1150	948	399	323	365	172	80	94	99	617
24	230	161	1160	817	439	328	430	174	77	104	107	861
25	241	196	1210	649	445	335	459	166	71	112	103	929
26	247	290	1230	494	408	360	435	158	73	116	96	897
27	246	384	1150	402	397	364	395	152	69	107	90	826
28	245	424	1030	361	397	355	371	148	68	97	90	718
29	242	435	882	346	396	358	350	143	70	90	88	568
30	233	465	695	360	---	431	327	137	69	84	83	435
31	224	---	604	535	---	562	---	133	---	80	80	---
TOTAL	5966	6960	21833	13974	14471	13840	20350	6366	2799	2292	2735	8608
MEAN	192	232	704	451	499	446	678	205	93.3	73.9	88.2	287
MAX	247	465	1230	1010	957	613	1670	306	128	116	107	929
MIN	147	155	369	219	321	323	326	133	68	50	69	71
CFSM	.50	.60	1.83	1.17	1.30	1.16	1.76	.53	.24	.19	.23	.75
IN.	.58	.67	2.11	1.35	1.40	1.34	1.97	.62	.27	.22	.26	.83

CAL YR 1987 TOTAL 90949 MEAN 249 MAX 1230 MIN 58 CFSM .65 IN 8.79
WTR YR 1988 TOTAL 120194 MEAN 328 MAX 1670 MIN 50 CFSM .85 IN 11.61

04118000 THORNAPPLE RIVER NEAR CALEDONIA, MI

LOCATION.--Lat 42°48'40", long 85°29'00", in NW1/4 sec.22, T.5 N., R.10 W., Kent County, Hydrologic Unit 04050007, on right bank 200 ft downstream from LaBarge powerplant, 2.3 mi northeast of Caledonia, and 3.3 mi downstream from Coldwater River.

DRAINAGE AREA.--773 mi².

PERIOD OF RECORD.--October 1930 to September 1938, October 1951 to March 1982, October 1983 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 824: 1931-36. WSP 1307: 1931-37.

GAGE.--Water-stage recorder. Datum of gage is 676.31 ft, Consumers Power Co. datum. Oct. 1, 1930, to Sept. 30, 1938, nonrecording gage at same site and at National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Prior to Dec. 1, 1958, and since Oct. 1, 1983, large diurnal fluctuation at low and medium flow, and occasional regulation during high flow, caused by powerplant upstream from station; occasional fluctuation during the interim period. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--43 years (water years 1931-38, 1952-81, 1984-88), 594 ft³/s, 10.44 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,700 ft³/s, Feb. 27, 1985, gage height, 11.43 ft; minimum, 1.0 ft³/s, May 28, 1968, gage height, 1.40 ft, result of regulation during bridge construction.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 7, 1947, reached a stage of 14.4 ft, from information by powerplant operator.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,240 ft³/s, Dec. 21, gage height, 7.8 ft, from graph based on gage readings; minimum daily, 172 ft³/s, July 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	494	530	1060	1170	1880	814	1240	654	316	195	215	214
2	485	572	1080	990	2030	861	1230	547	313	190	205	217
3	486	587	1050	898	1930	914	1280	533	268	226	187	210
4	515	588	996	816	1810	917	1530	521	334	203	212	237
5	429	574	909	603	1580	873	1490	496	255	184	211	259
6	427	549	830	586	1290	818	1440	491	306	198	210	268
7	422	526	766	595	1160	781	1890	481	304	196	201	272
8	414	512	806	569	1030	797	2070	457	232	184	237	248
9	385	451	1000	576	947	940	2300	448	275	195	223	235
10	382	448	1180	607	877	1070	2500	455	277	186	278	258
11	336	437	1250	584	785	1100	2520	448	267	172	225	221
12	400	401	1280	591	747	1110	2260	449	230	183	233	209
13	344	404	1260	574	715	1150	1900	456	270	178	271	238
14	416	416	1180	517	683	1100	1600	449	247	176	206	243
15	324	404	1140	504	765	1050	1300	441	243	186	241	243
16	362	391	1070	512	792	978	1070	436	245	225	212	246
17	326	387	1020	588	842	891	929	421	245	245	192	242
18	331	381	1010	979	852	828	833	410	243	240	278	225
19	371	374	1010	1320	885	792	767	413	221	230	291	303
20	336	380	1430	1700	873	757	710	411	240	233	207	415
21	467	347	1970	1940	737	714	682	408	207	213	268	452
22	444	340	2100	1840	786	688	661	349	214	212	236	482
23	497	438	2140	1780	777	663	677	363	243	240	235	1120
24	487	383	2160	1600	786	647	747	400	216	249	303	1310
25	533	437	2410	1350	793	657	776	402	201	327	238	1390
26	509	634	2610	1050	769	691	776	338	208	254	247	1380
27	530	711	2490	860	768	692	759	351	212	343	250	1300
28	525	740	2220	792	749	686	736	341	216	206	214	1140
29	512	809	1960	752	768	696	699	346	216	228	225	871
30	490	972	1500	789	---	911	663	301	209	237	230	775
31	459	---	1380	1280	---	1190	---	329	---	226	239	---
TOTAL	13438	15123	44287	29312	29406	26776	38035	13345	7473	6762	7220	15223
MEAN	433	504	1429	946	1014	864	1268	430	249	218	233	507
MAX	533	972	2610	1940	2030	1190	2520	654	334	343	303	1390
MIN	324	340	766	504	683	647	661	301	201	172	187	209
CFSM	.56	.65	1.85	1.22	1.31	1.12	1.64	.56	.32	.28	.30	.66
IN.	.65	.73	2.13	1.41	1.42	1.29	1.83	.64	.36	.33	.35	.73

CAL YR 1987 TOTAL 198576 MEAN 544 MAX 2610 MIN 181 CFSM .70 IN 9.56
WTR YR 1988 TOTAL 246400 MEAN 673 MAX 2610 MIN 172 CFSM .87 IN 11.86

04118500 ROGUE RIVER NEAR ROCKFORD, MI

LOCATION (REVISED).--Lat 43°04'56", long 85°35'27", in NE1/4 sec.15, T.8 N., R.11 W., Kent County, Hydrologic Unit 04050006, on left bank at downstream side of bridge on Packer Drive, 2.2 mi upstream from mouth, and 3.0 mi southwest of Rockford.

DRAINAGE AREA.--234 mi^2.

PERIOD OF RECORD.--February 1952 to September 1982, October 1987 to September 1988.

GAGE.--Water-stage recorder. Datum of gage is 624.80 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.). Prior to Aug. 30, 1952, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 4-20, Dec. 28 to Jan. 15, Jan. 26 to Mar. 5, and Sept. 1-15. Records good except for estimated daily discharges, which are fair. Some diurnal fluctuation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 231 ft^3/s, 13.41 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,540 ft^3/s, Mar. 6, 1976, gage height, 9.29 ft; minimum, 28 ft^3/s, Jan. 22, 1967, gage height, 3.41 ft; minimum daily, 49 ft^3/s, Aug. 27, 1955.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sept. 12, 1986, reached a stage of 11.35 ft, from floodmark, and discharge of about 6,000 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,800 ft^3/s, Feb. 1; maximum gage height, 7.92 ft, Feb. 1, backwater from ice; minimum discharge, 79 ft^3/s, Aug. 5, gage height, 3.49 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	199	269	500	290	1580	285	767	367	143	99	92	105
2	216	271	498	260	1400	310	653	336	143	96	89	105
3	213	279	477	240	970	320	708	310	143	94	86	105
4	211	280	426	230	700	315	788	288	138	91	82	130
5	208	270	378	220	500	300	889	273	135	90	84	145
6	202	265	338	215	400	298	859	262	132	89	95	155
7	194	260	320	215	350	304	874	249	130	88	98	135
8	188	250	336	215	320	353	856	236	124	85	94	130
9	183	245	410	215	305	463	685	241	121	84	156	120
10	178	240	463	215	300	476	545	254	120	84	143	115
11	175	235	504	225	300	481	464	254	121	86	132	115
12	172	230	534	230	300	477	414	253	118	86	119	110
13	170	225	493	230	300	462	380	250	115	86	114	110
14	168	220	438	235	300	443	382	239	117	85	111	125
15	166	215	399	240	300	425	366	229	114	98	111	125
16	166	210	386	250	295	402	353	228	110	118	105	115
17	172	210	383	307	295	357	342	219	110	137	107	116
18	178	205	358	337	290	336	329	211	108	126	160	119
19	185	200	358	339	290	318	312	202	106	117	163	160
20	217	200	508	432	290	304	317	192	104	111	155	195
21	267	200	570	427	285	286	331	191	102	107	133	187
22	283	195	664	469	280	282	326	188	104	101	121	245
23	325	199	613	400	275	277	468	177	107	104	156	514
24	332	201	541	351	290	276	518	175	106	104	157	399
25	328	277	547	324	280	298	554	169	103	111	150	394
26	325	295	589	240	265	303	530	165	100	107	133	351
27	332	319	540	220	260	309	488	159	98	102	123	308
28	312	324	450	260	275	316	462	155	99	97	119	258
29	297	375	380	250	280	353	432	152	103	93	115	211
30	278	458	340	390	---	533	397	147	103	96	112	185
31	261	---	320	910	---	658	---	146	---	93	109	---
TOTAL	7101	7622	14061	9381	12275	11320	15789	6917	3477	3065	3724	5587
MEAN	229	254	454	303	423	365	526	223	116	98.9	120	186
MAX	332	458	664	910	1580	658	889	367	143	137	163	514
MIN	166	195	320	215	260	276	312	146	98	84	82	105
CFSM	.98	1.09	1.94	1.30	1.81	1.56	2.25	.95	.50	.42	.51	.80
IN.	1.13	1.21	2.24	1.49	1.95	1.80	2.51	1.10	.55	.49	.59	.89

WTR YR 1988 TOTAL 100319 MEAN 274 MAX 1580 MIN 82 CFSM 1.17 IN 15.95

04119000 GRAND RIVER AT GRAND RAPIDS, MI

LOCATION.--Lat 42°57'52", long 85°40'35", in NE1/4 sec.25, T.7 N., R.12 W., Kent County, Hydrologic Unit 04050006, on right bank 500 ft upstream from bridge on Fulton Street, 1.7 mi upstream from Plaster Creek, and at mile 41.

DRAINAGE AREA.--4,900 mi², approximately.

PERIOD OF RECORD.--March 1901 to December 1905, January 1906 to August 1918 (gage heights only), October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records collected in this vicinity since 1907 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 924: 1938(M). WSP 1387: 1901-5, 1940.

GAGE.--Water-stage recorder. Datum of gage is 585.70 ft above National Geodetic Vertical Datum of 1929 (levels by City of Grand Rapids). March 1901 to August 1918, nonrecording gage at Fulton Street Bridge 500 ft downstream and Oct. 1, 1930, to Oct. 26, 1953, water-stage recorder at sewage pumping station 1 mi downstream at datum 2.99 ft higher.

REMARKS.--Estimated daily discharges: Jan. 4 to Mar. 1. Records good except for estimated daily discharges, which are fair. Moderate diurnal fluctuation at low and medium flow caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--62 years, 3,628 ft³/s, 10.05 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 54,000 ft³/s, Mar. 28, 1904, gage height, 19.5 ft, from graph based on gage readings, site then in use; maximum gage height, 19.64 ft, Mar. 1, 1985; minimum daily discharge, 381 ft³/s, Aug. 9, 17, 1936.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1901, that of Mar. 28, 1904.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 12,400 ft³/s, Apr. 11, gage height, 12.12 ft; maximum gage height, 12.80 ft, Feb. 8, backwater from ice; minimum discharge, 750 ft³/s, July 10, gage height, 2.81 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2280	3080	6070	6770	7600	4830	7210	4800	1770	1010	1190	1100
2	2450	3330	6210	6110	8000	4820	7160	4230	1940	925	1060	1120
3	2400	3760	5880	5460	8800	4790	7480	4020	1800	927	894	1100
4	2310	3700	5690	4700	8200	4790	8200	4030	1830	919	943	1360
5	2300	3600	5560	4300	7200	4630	8530	3840	1730	897	908	1570
6	2250	3490	5240	4100	5500	4590	8760	3640	1650	800	1070	1630
7	2220	3120	5020	3900	4900	4630	9260	3450	1530	835	1040	1410
8	2230	3150	4890	3800	5100	4580	10000	3400	1780	866	904	1450
9	2130	2960	5590	3600	5400	5050	11200	3330	1700	845	1100	1230
10	2060	2890	6410	3500	5600	5920	12200	3420	1440	867	1320	1200
11	2000	2690	6790	3300	5400	6410	12300	3420	1410	911	1640	1260
12	1940	2520	6980	3200	5300	6560	11700	3150	1410	879	1330	1130
13	1990	2520	6760	3000	5000	6740	10700	3060	1170	885	1270	1160
14	1960	2570	6500	2800	4700	7040	9620	2980	1180	823	1230	1320
15	1990	2370	6390	2500	4800	7010	8640	2910	1250	838	1040	1320
16	2010	2530	6120	2800	5100	6890	7520	2840	1190	1150	1050	1250
17	2110	2600	6190	2650	5300	6560	6600	2730	1200	1520	1100	1230
18	2040	2530	6250	4500	5500	6260	6080	2830	1180	1260	1520	1210
19	2060	2580	6220	6200	5600	6010	5560	2670	1130	1380	1740	1360
20	2150	2530	7140	7200	5500	5800	5260	2690	1050	1430	2090	1800
21	2560	2540	8510	7700	5300	5580	5260	2700	987	1170	1820	2010
22	2790	2460	9530	7500	5200	5400	5130	2610	1060	1260	1400	2930
23	3020	2480	10000	7100	6000	5150	5290	2470	1040	1090	1560	5940
24	3100	2480	10100	6500	6200	4920	5430	2430	1070	1050	1540	6400
25	3050	2750	10200	6000	6100	4990	5570	2350	1060	1120	1620	6260
26	2690	3470	10400	5400	5800	5090	5610	2320	999	1320	1430	5470
27	2880	4640	10500	4900	5300	5090	5640	2190	910	1230	1290	4790
28	3080	4780	10300	4400	4900	5130	5470	2220	963	1220	1270	4290
29	3190	4770	9580	3900	4850	5260	5380	2190	987	1000	1210	3770
30	3050	5500	8540	4400	---	6230	4980	2080	989	1200	1200	3110
31	3040	---	7360	6000	---	6960	---	1800	---	1120	1150	---
TOTAL	75330	94410	226920	148190	168150	173710	227740	92800	39405	32747	39929	71180
MEAN	2430	3147	7320	4780	5798	5604	7591	2994	1314	1056	1288	2373
MAX	3190	5500	10500	7700	8800	7040	12300	4800	1940	1520	2090	6400
MIN	1940	2370	4890	2500	4700	4580	4980	1800	910	800	894	1100
CFSM	.50	.64	1.49	.98	1.18	1.14	1.55	.61	.27	.22	.26	.48
IN.	.57	.72	1.72	1.13	1.28	1.32	1.73	.70	.30	.25	.30	.54

CAL YR 1987 TOTAL 1186906 MEAN 3252 MAX 10500 MIN 986 CFSM .66 IN 9.01
WTR YR 1988 TOTAL 1390511 MEAN 3799 MAX 12300 MIN 800 CFSM .78 IN 10.56

04119300 GRAND RIVER AT EASTMANVILLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°00'53", long 85°57'21", in NE1/4 NW1/4 sec.10, T.7 N., R.14 W., Ottawa County, Hydrologic Unit 04050006, at bridge on 68th Avenue in Eastmanville, 1.1 mi downstream from Deer Creek, and at mile 19.3.

DRAINAGE AREA.--5,230 mi², approximately.

PERIOD OF RECORD.--Water years 1979 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1979 to September 1983.
WATER TEMPERATURE: February 1979 to September 1983.

INSTRUMENTATION.--Water-quality monitor from Oct. 7, 1980 to Sept. 30, 1983.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge. A water-discharge measurement was made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-82): Maximum daily recorded (more than 20 percent missing record), 1,100 microsiemens, Mar. 2, 1979; minimum measured, 324 microsiemens, Mar. 24, 1982.
WATER TEMPERATURE (water years 1980-81, 1983): Maximum, 28.5°C, July 21, 1983; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
18...	1200	2560	738	8.1	8.0	2.7	11.6	99	1500	230
JAN										
28...	1400	4870	648	8.1	0.5	4.7	12.2	85	700	K2100
MAR										
24...	1030	5270	616	8.4	6.5	1.3	12.4	104	1100	1200
MAY										
19...	1000	2610	661	8.6	18.0	5.0	12.9	140	K210	K14
JUL										
25...	1400	1440	660	8.7	25.0	17	16.6	206	K100	K110
SEP										
22...	1030	3000	611	8.2	16.0	18	8.6	90	E870	760

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
18...	320	88	87	25	26	15	0.7	3.0	283	0
JAN										
28...	290	--	78	22	24	15	0.6	3.6	--	--
MAR										
24...	290	88	80	23	20	13	0.5	2.4	246	2
MAY										
19...	300	77	80	25	28	17	0.7	2.5	261	7
JUL										
25...	260	92	62	26	44	26	1	3.3	188	10
SEP										
22...	250	--	61	23	28	20	0.8	2.8	--	--

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV									
18...	232	67	48	0.30	6.9	438	0.60	3030	0.050
JAN									
28...	--	64	42	0.20	8.5	391	0.53	5140	0.030
MAR									
24...	206	63	35	0.20	4.9	372	0.51	5290	<0.010
MAY									
19...	226	63	47	0.30	2.3	397	0.54	2800	0.030
JUL									
25...	170	69	77	0.30	3.5	387	0.53	1500	0.050
SEP									
22...	--	59	47	0.20	5.6	356	0.48	2880	0.030

04119300 GRAND RIVER AT EASTMANVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
NOV 18...	1.30	--	0.230	1.0	0.030	0.020	<0.010	<10	1	54
JAN 28...	2.40	0.460	0.450	1.3	0.090	0.050	0.030	--	--	--
MAR 24...	1.70	0.350	--	1.0	0.050	0.020	0.010	10	<1	43
MAY 19...	0.570	--	0.320	0.90	0.030	0.020	<0.010	10	1	53
JUL 25...	0.410	0.010	<0.010	1.4	0.100	0.030	<0.010	10	1	51
SEP 22...	0.640	0.470	0.460	1.6	0.050	0.020	<0.010	--	--	--

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
NOV 18...	<0.5	<1	2	<3	<1	26	<5	5	16	<0.1
JAN 28...	--	--	--	--	--	--	--	--	--	--
MAR 24...	<0.5	<1	1	<3	1	16	<5	16	17	<0.1
MAY 19...	<0.5	<1	<1	<3	1	6	<5	12	3	<0.1
JUL 25...	<0.5	<1	1	<3	2	14	<5	9	3	<0.1
SEP 22...	--	--	--	--	--	--	--	--	--	--

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 18...	<10	<1	<1	<1.0	310	<6	11	18	124	79
JAN 28...	--	--	--	--	--	--	--	10	131	94
MAR 24...	<10	7	<1	1.0	220	<6	6	16	228	90
MAY 19...	<10	<1	<1	<1.0	310	<6	<3	22	155	99
JUL 25...	<10	7	<1	<1.0	380	<6	19	35	136	92
SEP 22...	--	--	--	--	--	--	--	41	332	83

442805084411001 HIGGINS LAKE NEAR ROSCOMMON, MI

LOCATION.--Lat 44°25'35", long 84°40'55", in NW1/4 SW1/4 sec. 33, T.24 N., R.3 W., Roscommon County, Hydrologic Unit 04060102, at South Higgins Lake State Park, 6.7 mi southwest of Roscommon.

DRAINAGE AREA.--49.1 mi², revised.

PERIOD OF RECORD.--September 1942 to current year.

GAGE.--Nonrecording gage. Datum of gage is 1,148.74 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Nov. 27, 1942 to June 9, 1988, water-stage recorder at same datum.

REMARKS.--Higgins Lake has two inlets, Big Creek and Little Creek. The outlet is "The Cut" which flows into Marl Lake and then into Houghton Lake. Streamflow records for the outlet (station 04120500) were collected from July 1942 to July 1950. Lake elevation maintained by a three bay dam with stop logs. Maximum depth 141 ft, surface area 9,900 acres. Established legal level; summer, 1,154.11 ft, winter, 1,153.61 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 6.23 ft, June 26, 1954; minimum, 4.32 ft, Oct. 3, 4, 1955.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 5.72 ft, Apr. 6, 7; minimum observed, 5.16 ft, July 8-10, 12, 19-21.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.33	5.21	5.32	5.42	5.56	5.49	5.60	5.61	5.46	5.47	5.20	5.38
2	5.36	5.21	5.31	5.40	5.54	5.49	5.59	5.60	5.44	5.57	5.30	5.38
3	5.34	5.23	5.30	5.39	5.55	5.49	5.64	5.59	5.42	5.47	5.20	5.37
4	5.31	5.25	5.30	5.40	5.55	5.49	5.66	5.59	5.41	5.37	5.20	5.47
5	5.30	5.26	5.29	5.38	5.54	5.48	5.65	5.58	5.40	5.27	5.30	5.47
6	5.30	5.25	5.28	5.37	5.53	5.48	5.68	5.57	5.40	5.17	5.19	5.38
7	5.30	5.24	5.28	5.36	5.53	5.48	5.70	5.57	5.39	5.17	5.19	5.47
8	5.28	5.26	5.29	5.36	5.53	5.48	5.69	5.55	5.38	5.16	5.49	5.47
9	5.26	5.26	5.33	5.36	5.53	5.51	5.68	5.56	5.38	5.16	5.19	5.37
10	5.24	5.24	5.34	5.35	5.53	5.49	5.68	5.59	5.35	5.16	5.19	5.27
11	5.23	5.23	5.33	5.35	5.52	5.46	5.67	5.58	5.40	5.26	5.19	5.40
12	5.22	5.22	5.35	5.35	5.53	5.48	5.67	5.57	5.30	5.16	5.39	5.30
13	5.20	5.22	5.35	5.36	5.53	5.51	5.66	5.60	5.30	5.36	5.29	5.40
14	5.19	5.22	5.35	5.35	5.53	5.51	5.67	5.57	5.50	5.26	5.59	5.40
15	5.19	5.21	5.39	5.36	5.52	5.51	5.65	5.56	5.40	5.26	5.39	5.25
16	5.18	5.21	5.43	5.35	5.52	5.51	5.65	5.56	5.40	5.26	5.29	5.24
17	5.20	5.20	5.41	5.36	5.53	5.51	5.64	5.55	5.39	5.26	5.39	5.25
18	5.19	5.23	5.39	5.42	5.53	5.51	5.64	5.55	5.29	5.26	5.39	5.25
19	5.19	5.21	5.40	5.41	5.53	5.51	5.62	5.54	5.39	5.16	5.29	5.28
20	5.19	5.22	5.44	5.44	5.53	5.51	5.61	5.53	5.39	5.16	5.28	5.36
21	5.19	5.21	5.43	5.45	5.53	5.51	5.59	5.53	5.49	5.16	5.28	5.34
22	5.19	5.19	5.43	5.44	5.52	5.51	5.58	5.54	---	5.35	5.38	5.32
23	5.20	5.19	5.43	5.46	5.51	5.50	5.61	5.53	5.29	5.20	5.38	5.38
24	5.22	5.21	5.43	5.46	5.51	5.49	5.62	5.52	5.38	5.20	5.48	5.34
25	5.21	5.22	5.44	5.47	5.50	5.48	5.60	5.49	5.58	5.30	5.33	5.30
26	5.20	5.23	5.43	5.47	5.50	5.49	5.60	5.48	5.38	5.30	5.28	5.30
27	5.25	5.22	5.43	5.47	5.50	5.50	5.61	5.48	5.26	5.20	5.38	5.30
28	5.24	5.22	5.43	5.46	5.49	5.49	5.64	5.47	5.28	5.20	5.38	5.28
29	5.24	5.25	5.43	5.46	5.49	5.51	5.63	5.47	5.28	5.40	5.38	5.29
30	5.23	5.31	5.41	5.47	---	5.59	5.61	5.46	5.48	5.40	5.28	5.28
31	5.22	---	5.42	5.55	---	5.60	---	5.46	---	5.20	5.28	---
MEAN	5.24	5.23	5.37	5.41	5.52	5.50	5.64	5.54	---	5.27	5.32	5.34
MAX	5.36	5.31	5.44	5.55	5.56	5.60	5.70	5.61	---	5.57	5.59	5.47
MIN	5.18	5.19	5.28	5.35	5.49	5.46	5.58	5.46	---	5.16	5.19	5.24

CAL YR 1987 MEAN 5.31 MAX 5.52 MIN 5.07

442400084472801 HOUGHTON LAKE NEAR HOUGHTON LAKE HEIGHTS, MI

LOCATION.--Lat 44°24'16", long 84°47'28", in NW1/4 NW1/4 sec.10, T.23 N., R.4 W., Roscommon County, Hydrologic Unit 04060102, on right bank of Muskegon River at upstream side of bridge on Old U.S. Highway 27, 0.4 mi downstream from Houghton Lake, and 5.2 mi north of Houghton Lake Heights.

DRAINAGE AREA.--222 mi².

PERIOD OF RECORD.--June 1942 to current year, except winter period of 1942-43.

GAGE.--Water-stage recorder. Datum of gage is 1,130.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Sept. 28, 1960, nonrecording gage at datum 6.21 ft higher.

REMARKS.--Backus Creek and "The Cut" from Higgins Lake, join about 1 mi upstream from Houghton Lake and become the major inlet. There are also many small tributaries which feed the lake. The outlet is Muskegon River. Houghton Lake is the largest inland lake in Michigan covering 19,600 acres, with a maximum depth of 20 ft. Established legal level; summer, 1,138.1 ft, minimum winter, 1,137.6 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 10.18 ft, Apr. 23, 1985; minimum observed, 6.95 ft, Sept. 3, 5, Nov. 8, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 9.33 ft, May 9; minimum, 7.78 ft, Nov. 5.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.24	8.14	8.16	8.40	8.29	8.14	8.47	9.22	8.86	8.33	8.14	8.14
2	8.11	8.13	8.18	8.39	8.31	8.12	8.51	9.24	8.89	8.34	8.14	8.12
3	8.18	8.13	8.21	8.38	8.31	8.12	8.61	9.24	8.82	8.35	8.15	8.14
4	8.22	8.08	8.17	8.36	8.31	8.11	8.69	9.23	8.79	8.34	8.19	8.12
5	8.24	7.99	8.19	8.37	8.31	8.10	8.75	9.20	8.75	8.33	8.20	8.10
6	8.21	8.04	8.22	8.34	8.30	8.10	8.75	9.18	8.75	8.32	8.14	8.14
7	8.14	8.09	8.22	8.33	8.30	8.08	8.83	9.20	8.77	8.30	8.19	8.17
8	8.22	8.09	8.22	8.31	8.29	8.09	8.95	9.26	8.74	8.28	8.18	8.21
9	8.21	8.09	8.25	8.30	8.29	8.09	8.99	9.24	8.66	8.26	8.20	8.13
10	8.22	8.08	8.27	8.29	8.28	8.09	9.00	9.13	8.68	8.26	8.28	8.11
11	8.22	8.09	8.33	8.28	8.26	8.09	9.02	9.12	8.67	8.23	8.27	8.15
12	8.23	8.09	8.30	8.27	8.26	8.11	9.06	9.16	8.67	8.21	8.26	8.14
13	8.21	8.08	8.30	8.24	8.26	8.13	9.08	9.02	8.67	8.26	8.27	8.12
14	8.16	8.08	8.31	8.24	8.26	8.13	9.02	9.16	8.67	8.18	8.23	8.11
15	8.14	8.10	8.34	8.24	8.25	8.13	9.07	9.14	8.60	8.22	8.17	8.15
16	8.15	8.09	8.28	8.23	8.25	8.13	9.08	9.07	8.62	8.19	8.26	8.22
17	8.10	8.17	8.39	8.22	8.25	8.13	9.09	9.07	8.63	8.18	8.21	8.16
18	8.11	8.01	8.41	8.27	8.24	8.12	9.01	9.08	8.60	8.19	8.24	8.17
19	8.09	8.04	8.41	8.26	8.23	8.12	9.10	9.07	8.59	8.16	8.21	8.33
20	8.12	7.95	8.45	8.28	8.22	8.12	9.10	9.06	8.52	8.17	8.17	8.27
21	8.12	8.04	8.45	8.27	8.22	8.12	9.11	9.05	8.55	8.13	8.15	8.22
22	8.17	8.06	8.45	8.26	8.21	8.11	9.16	9.03	8.53	8.16	8.19	8.32
23	8.12	8.04	8.45	8.26	8.20	8.11	9.20	9.01	8.53	8.16	8.21	8.23
24	8.10	8.03	8.45	8.25	8.19	8.11	9.10	8.89	8.59	8.14	8.11	8.30
25	8.12	8.03	8.45	8.25	8.18	8.15	9.19	8.91	8.39	8.14	8.08	8.28
26	8.17	8.06	8.45	8.24	8.17	8.18	9.17	8.94	8.38	8.10	8.10	8.32
27	8.10	8.09	8.44	8.24	8.16	8.19	9.25	8.92	8.42	8.11	8.16	8.27
28	8.12	8.09	8.43	8.23	8.15	8.22	9.16	8.91	8.39	8.10	8.12	8.31
29	8.14	8.10	8.42	8.23	8.14	8.25	9.16	8.90	8.35	8.11	8.10	8.27
30	8.09	8.15	8.42	8.22	---	8.37	9.19	8.88	8.35	8.09	8.11	8.17
31	8.12	---	8.41	8.27	---	8.43	---	8.87	---	8.15	8.15	---
MEAN	8.16	8.08	8.34	8.28	8.24	8.14	9.00	9.08	8.61	8.21	8.18	8.20
MAX	8.24	8.17	8.45	8.40	8.31	8.43	9.25	9.26	8.89	8.35	8.28	8.33
MIN	8.09	7.95	8.16	8.22	8.14	8.08	8.47	8.87	8.35	8.09	8.08	8.10

CAL YR 1987 MEAN 8.22 MAX 8.91 MIN 7.60
WTR YR 1988 MEAN 8.38 MAX 9.26 MIN 7.95

04121300 CLAM RIVER AT VOGEL CENTER, MI

LOCATION.--Lat 44°12'02", long 85°03'10", in SW1/4 NW1/4 sec.21, T.21 N., R.6 W., Missaukee County, Hydrologic Unit 04060102, on left bank 10 ft downstream from bridge on 8 Mile Road, 0.5 mi north of Vogel Center, and 3.5 mi southeast of Falmouth.

DRAINAGE AREA.--243 mi².

PERIOD OF RECORD.--June 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,130 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Jan. 4, 7-16, 22, 24-27, Feb. 6-14, 26 and Mar. 2, 3. Records good except for estimated daily discharges, which are fair. Some regulation at low flow by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 128 ft³/s, 7.15 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,150 ft³/s, Apr. 13, 1971, gage height, 6.33 ft; minimum, 29 ft³/s, Nov. 3, 1969, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 350 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 2	0600	*607	*5.01	Apr. 4	1900	450	4.52
Mar. 26	2400	427	4.44				

Minimum discharge, 50 ft³/s, July 7-10, gage height, 2.35 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	102	120	233	140	470	132	383	159	72	60	67	61
2	117	119	218	132	586	130	356	147	72	58	63	59
3	129	121	182	134	482	125	377	122	72	58	60	60
4	123	125	161	128	320	124	437	112	71	56	58	70
5	116	127	149	120	244	133	419	109	70	54	61	125
6	113	126	138	119	158	133	349	107	68	54	65	130
7	114	122	135	122	150	132	318	103	66	53	66	101
8	115	122	137	125	150	158	302	103	66	51	69	80
9	113	123	176	125	151	208	266	103	68	51	70	69
10	108	120	235	127	151	230	237	109	67	53	78	65
11	107	116	245	125	150	250	222	112	67	56	76	64
12	110	114	218	129	148	259	212	106	65	58	97	64
13	108	114	196	130	147	218	204	105	63	57	110	66
14	107	112	180	132	147	188	198	113	62	55	103	66
15	106	111	144	125	146	176	195	127	60	56	87	65
16	106	109	128	128	148	164	192	106	60	60	75	63
17	106	110	163	129	146	152	190	98	64	63	70	64
18	110	112	166	137	153	149	188	95	60	62	66	70
19	110	114	155	149	150	146	187	90	59	59	65	80
20	108	113	153	153	148	141	186	91	59	57	62	94
21	110	106	157	152	143	133	183	84	58	58	59	97
22	116	113	163	142	137	135	178	85	65	57	58	88
23	124	114	162	132	147	138	185	81	70	58	61	87
24	133	130	163	129	147	174	198	78	68	59	64	85
25	141	135	165	128	141	256	198	77	63	58	66	79
26	136	133	165	127	140	385	180	76	60	62	66	71
27	135	130	160	127	139	387	147	75	58	63	66	68
28	136	128	167	127	143	285	145	75	59	61	64	66
29	135	144	152	134	137	255	161	75	63	56	63	66
30	131	195	131	141	---	319	163	74	62	61	64	66
31	124	---	131	298	---	378	---	72	---	67	63	---
TOTAL	3649	3678	5228	4246	5619	6193	7156	3069	1937	1791	2162	2289
MEAN	118	123	169	137	194	200	239	99.0	64.6	57.8	69.7	76.3
MAX	141	195	245	298	586	387	437	159	72	67	110	130
MIN	102	106	128	119	137	124	145	72	58	51	58	59
CFSM	.49	.51	.70	.56	.80	.82	.98	.41	.27	.24	.29	.31
IN.	.56	.56	.80	.65	.86	.95	1.10	.47	.30	.27	.33	.35

CAL YR 1987 TOTAL 39202 MEAN 107 MAX 337 MIN 50 CFSM .44 IN 6.00
WTR YR 1988 TOTAL 47017 MEAN 128 MAX 586 MIN 51 CFSM .53 IN 7.20

04121500 MUSKEGON RIVER AT EVART, MI

LOCATION.--Lat 43°53'57", long 85°15'19", in NW1/4 NE1/4 sec.3, T.17 N., R.8 W., Osceola County, Hydrologic Unit 04060102, on right bank 500 ft downstream from bridge on U.S. Highway 10 in Evart, 0.4 mi upstream from Twin Creek, and at mile 123.9.

DRAINAGE AREA.--1,450 mi², approximately.

PERIOD OF RECORD.--October 1930 to September 1931, October 1933 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1437: 1934, 1947(M).

GAGE.--Water-stage recorder. Datum of gage is 977.72 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 7, 1956, nonrecording gages at sites 400 ft and 500 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 28-30, Jan. 4, 6-29, Feb. 6-14, 16, 18, 19, 21, 23, 26, 28, 29, Mar. 1, 3-6, and Apr. 1-7. Records good except for estimated daily discharges, which are poor. Some regulation at low flow by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--56 years, 1,012 ft³/s, 9.48 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,790 ft³/s, Mar. 29, 1976; maximum gage height, 14.42 ft, Apr. 9, 1959; minimum discharge observed, 164 ft³/s, Dec. 20, 1947, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,630 ft³/s, Apr. 6, based on correlation with nearby streams; minimum discharge, 304 ft³/s, July 10, gage height, 6.46 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	609	947	1670	1020	2710	840	3600	1180	540	356	378	350
2	653	949	1720	906	2750	817	3650	1150	530	352	375	335
3	691	950	1650	844	2980	810	3800	1100	526	347	374	336
4	705	957	1550	780	2620	820	4000	1050	515	341	377	484
5	705	956	1500	720	2240	840	4400	1010	492	334	385	687
6	697	944	1450	760	1700	850	4550	976	465	329	447	626
7	672	925	1410	800	1500	851	4200	937	446	326	430	590
8	652	923	1380	810	1250	935	3930	910	427	320	413	549
9	647	935	1620	820	1100	1450	3650	904	431	315	427	500
10	640	925	1830	820	1050	1650	3340	943	422	310	415	451
11	622	916	1860	820	980	1700	3000	929	419	331	406	411
12	601	910	1870	830	950	1870	2700	898	411	339	432	399
13	592	910	1790	840	940	1950	2450	892	402	332	463	393
14	586	908	1690	850	940	1770	2260	885	392	329	455	388
15	583	889	1600	830	936	1610	2100	861	384	328	434	377
16	569	870	1520	830	910	1530	1940	853	373	351	410	375
17	578	870	1440	850	902	1500	1800	821	370	379	402	388
18	611	872	1430	900	905	1390	1670	789	367	373	406	396
19	640	866	1420	960	905	1270	1560	774	361	368	393	437
20	666	853	1400	980	907	1190	1470	763	357	361	377	576
21	710	827	1380	990	900	1140	1380	744	352	351	366	592
22	791	827	1350	930	891	1110	1290	726	367	346	356	595
23	873	856	1300	850	900	1090	1350	709	384	366	351	641
24	905	888	1310	830	902	1330	1410	688	386	359	363	616
25	947	931	1340	830	900	1730	1350	663	377	391	365	577
26	949	1000	1350	820	900	2270	1290	649	364	453	362	548
27	976	1020	1220	830	896	2390	1290	639	355	443	358	529
28	986	1030	1140	840	880	2330	1280	619	351	416	360	501
29	977	1170	1080	860	860	2380	1240	597	353	395	353	506
30	965	1460	1040	977	---	2900	1200	580	360	388	346	481
31	945	---	1020	2070	---	3360	---	565	---	387	351	---
TOTAL	22743	28284	45330	27797	37204	47673	73150	25804	12279	11116	12130	14634
MEAN	734	943	1462	897	1283	1538	2438	832	409	359	391	488
MAX	986	1460	1870	2070	2980	3360	4550	1180	540	453	463	687
MIN	569	827	1020	720	860	810	1200	565	351	310	346	335
CFSM	.51	.65	1.01	.62	.89	1.06	1.68	.57	.28	.25	.27	.34
IN.	.58	.73	1.16	.71	.95	1.22	1.88	.66	.32	.29	.31	.38

CAL YR 1987 TOTAL 301669 MEAN 826 MAX 2030 MIN 285 CFSM .57 IN 7.74
WTR YR 1988 TOTAL 358144 MEAN 979 MAX 4550 MIN 310 CFSM .68 IN 9.19

04121900 LITTLE MUSKEGON RIVER NEAR MORLEY, MI

LOCATION.--Lat 43°30'09", long 85°20'33", in SW1/4 SW1/4 sec.24, T.13 N., R.9 W., Mecosta County, Hydrologic Unit 04060102, on right bank at upstream side of highway bridge on 130th Avenue, 0.5 mi downstream from Rustford Dam, and 5.2 mi east of Morley.

DRAINAGE AREA.--138 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 920 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30, Jan. 2, 3, 5-19, and Feb. 6-24. Records good except for estimated daily discharges, which are fair. Some regulation by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 130 ft³/s, 12.79 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,300 ft³/s, Sept. 12, 1986, gage height, 8.57 ft; minimum, 22 ft³/s, July 21, 1979; minimum gage height, 1.51 ft, July 28, 1987.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 31	2300	*704	*4.68	Apr. 4	0530	512	3.93
Mar. 30	2030	411	3.49				

Minimum discharge, 24 ft³/s, July 6, gage height, 1.54 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	92	109	242	112	609	113	341	147	66	40	54	50
2	108	112	210	111	372	113	274	140	65	40	52	49
3	113	114	168	110	285	112	347	130	64	41	47	57
4	104	110	152	109	203	109	495	106	63	40	45	77
5	97	106	141	105	164	107	462	104	62	36	48	120
6	94	102	129	110	145	113	373	101	62	38	57	91
7	102	100	123	110	132	125	348	99	59	37	52	75
8	100	101	137	112	132	159	294	100	59	37	52	65
9	96	105	195	111	131	266	250	102	63	36	75	60
10	92	102	208	112	130	212	215	127	61	37	78	59
11	76	98	185	115	130	183	194	143	58	40	70	55
12	77	98	181	118	129	213	182	134	59	42	65	56
13	76	101	169	118	128	254	171	125	59	41	74	64
14	79	100	151	113	128	202	180	110	55	40	77	66
15	78	98	140	113	129	170	180	107	49	38	62	57
16	79	98	151	115	130	157	169	109	50	44	53	56
17	86	99	149	122	131	147	150	98	48	47	51	59
18	90	102	145	132	131	148	147	93	48	45	70	59
19	82	100	141	138	131	146	139	91	51	45	65	73
20	92	99	184	144	128	140	138	88	47	43	57	133
21	104	95	202	148	122	131	143	90	45	43	54	133
22	125	94	182	140	121	127	139	91	51	42	49	123
23	142	99	165	122	121	134	268	87	53	49	58	174
24	140	103	158	117	121	161	288	82	49	51	60	143
25	140	112	185	114	119	197	233	80	48	53	60	111
26	126	132	182	114	115	230	186	78	48	58	53	97
27	126	125	156	126	111	217	177	76	45	54	51	91
28	123	121	144	127	112	181	182	74	45	52	58	84
29	115	171	134	122	113	194	167	76	44	52	57	66
30	112	250	125	146	---	354	154	75	41	52	54	67
31	107	---	120	497	---	386	---	71	---	60	55	---
TOTAL	3173	3356	5054	4103	4653	5501	6986	3134	1617	1373	1813	2470
MEAN	102	112	163	132	160	177	233	101	53.9	44.3	58.5	82.3
MAX	142	250	242	497	609	386	495	147	66	60	78	174
MIN	76	94	120	105	111	107	138	71	41	36	45	49
CFSM	.74	.81	1.18	.96	1.16	1.28	1.69	.73	.39	.32	.42	.60
IN.	.86	.90	1.36	1.11	1.25	1.48	1.88	.84	.44	.37	.49	.67

CAL YR 1987 TOTAL 42184 MEAN 116 MAX 269 MIN 42 CFSM .84 IN 11.37
WTR YR 1988 TOTAL 43233 MEAN 118 MAX 609 MIN 36 CFSM .86 IN 11.65

04122000 MUSKEGON RIVER AT NEWAYGO, MI

LOCATION.--Lat 43°25'20", long 85°48'04", in NE1/4 NE1/4 sec.24, T.12 N., R.13 W., Newaygo County, Hydrologic Unit 04060102, on left bank near nonoperative powerplant in Newaygo, 600 ft downstream from Penoyer Creek, and at mile 39.1.

DRAINAGE AREA.--2,350 mi², approximately.

PERIOD OF RECORD.--July to December 1908, July 1909 to July 1915, January 1916 to December 1919, October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Records for June 1901 to December 1906, published in WSP 129, 170, and 206, are unreliable and should not be used.

REVISED RECORDS.--WSP 974: 1933, 1935, 1937-38. WSP 1307: 1940(M). See also PERIOD OF RECORD.

GAGE.--Water-stage recorder. Datum of gage is 625.83 ft above National Geodetic Vertical Datum of 1929. October 1930 to January 1939, nonrecording gage, and Jan. 31, 1939 to Sept. 30, 1963, water-stage recorder at present site at datum 40.0 ft lower.

REMARKS.--Estimated daily discharges: Jan. 7 and 8. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants upstream from station, the largest of which are Croton Dam, Hardy Dam (since 1931), and Rogers Dam. Since Dec. 27, 1965, powerplant at Newaygo nonoperative, and in January 1969, dam at Newaygo was removed. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--66 years (water years 1910-14, 1917-19, 1931-88), 2,002 ft³/s, 11.57 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 23,200 ft³/s, Sept. 12, 1986, gage height, 19.54 ft, from floodmark; minimum, 52 ft³/s, Oct. 2, 1965, gage height, 5.31 ft, result of regulation during pipeline repair; minimum daily, 330 ft³/s, Feb. 15, 1914.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,280 ft³/s, Apr. 4, gage height, 10.57 ft; minimum, 697 ft³/s, July 6, 7, gage height, 6.39 ft; minimum daily, 704 ft³/s, July 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1610	1710	3340	1640	5640	2580	5690	2070	1260	1020	1140	926
2	1600	2300	3790	2820	5600	2430	5670	1990	1260	1010	1260	890
3	1610	2020	3690	2550	3940	2250	5860	1810	1260	1000	1250	951
4	1650	2080	3620	1720	4500	2230	6010	1760	1260	1000	949	1020
5	1640	2070	2580	1080	4890	2140	5490	1750	1260	823	979	1130
6	1650	1900	2360	1760	4640	2020	5510	1740	1260	704	895	1500
7	1580	1720	2670	1830	4050	1870	5460	1770	1240	713	861	1850
8	1550	1870	2730	1830	3920	1950	4410	1820	1160	738	855	1560
9	1240	1860	3260	1820	3740	2900	3740	1800	1150	737	911	1140
10	1030	1770	3760	2030	3830	3460	3720	1820	1150	857	1070	1190
11	1580	1820	3580	2240	3720	3490	3710	1850	1110	996	1140	1190
12	1500	1870	3610	2240	3600	3670	3560	1930	1070	953	1140	1200
13	1230	1820	3760	2240	3310	3760	3430	2230	1020	915	1130	1200
14	1240	1820	3810	2110	3140	3750	3430	2130	1020	870	1120	1150
15	1300	1840	3830	1760	3020	3740	3420	1930	1030	867	1120	1080
16	1310	1780	3750	2000	3020	3600	3410	1790	1020	952	1110	1040
17	1330	1860	3560	2280	3020	3390	3250	1790	1020	1010	1120	1010
18	1300	1890	3370	2700	3080	2970	2260	1790	1030	1070	1180	1030
19	1310	1800	2620	2970	3030	2610	2250	1760	1030	1060	1150	1300
20	1370	1670	2940	2940	3050	2600	2480	1640	1030	1030	1140	1520
21	1780	1650	2340	3020	3110	2590	1780	1600	1020	925	1080	1880
22	1810	1740	2550	3120	2600	2450	2010	1610	1040	925	1040	1850
23	1690	1640	2680	3180	2810	2310	2470	1600	1020	924	985	1920
24	2210	1540	3270	3000	2930	2300	2880	1600	1020	925	1060	2010
25	1700	1920	3650	2790	2580	2320	3600	1600	1030	940	1020	1980
26	1760	1880	3810	2550	2570	2880	3350	1560	1020	1060	954	1570
27	2290	2350	3610	2230	2570	3610	2460	1250	1020	1120	915	1110
28	2050	2150	2610	1960	2570	3660	2250	1200	1020	1090	980	1290
29	2110	2370	1900	2410	2650	4030	2260	1250	1020	1050	978	1420
30	2280	2930	1110	3260	---	4890	2270	1280	1020	1050	960	1370
31	2170	---	1110	4030	---	5490	---	1270	---	1040	935	---
TOTAL	50480	57640	95270	74110	101130	93940	108090	52990	32870	29374	32427	40277
MEAN	1628	1921	3073	2391	3487	3030	3603	1709	1096	948	1046	1343
MAX	2290	2930	3830	4030	5640	5490	6010	2230	1260	1120	1260	2010
MIN	1030	1540	1110	1080	2570	1870	1780	1200	1020	704	855	890
CFSM	.69	.82	1.31	1.02	1.48	1.29	1.53	.73	.47	.40	.45	.57
IN.	.80	.91	1.51	1.17	1.60	1.49	1.71	.84	.52	.46	.51	.64

CAL YR 1987 TOTAL 687710 MEAN 1884 MAX 3830 MIN 828 CFSM .80 IN 10.89
WTR YR 1988 TOTAL 768598 MEAN 2100 MAX 6010 MIN 704 CFSM .89 IN 12.17

04122030 MUSKEGON RIVER NEAR BRIDGETON, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°19'05", long 86°02'11", in SW1/4 NW1/4 sec.30, T.11 N., R.14 W., Newaygo County, Hydrologic Unit 04060102, at bridge on Maple Island Road, 5 mi southwest of Bridgeton, 13 mi upstream from Muskegon Lake, and 20 mi downstream from gaging station at Newaygo.

DRAINAGE AREA.--2,420 mi², approximately.

PERIOD OF RECORD.--Water years 1974 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Nov. 12, 1975 to Sept. 24, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge. Water-discharge measurements were made at time of sampling. Some regulation by upstream dams.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975, 1978-81): Maximum, 1,550 microsiemens, Sept. 24, 1979; minimum, 69 microsiemens, May 3, 1979.
WATER TEMPERATURE (water years 1975, 1977-81): Maximum, 33.0°C, July 19, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
13...	0945	2090	432	8.26	7.5	0.40	11.9	102	K11	K17
MAR										
16...	1130	3900	387	7.90	1.5	2.8	--	--	K5	--
MAY										
04...	1030	1840	332	8.19	12.0	2.8	10.0	95	K7	K12
AUG										
31...	0930	987	328	8.31	20.0	2.5	8.3	93	K31	K14

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
13...	200	39	53	16	11	11	0.4	1.2	194	0
MAR										
16...	170	22	45	13	11	12	0.4	1.4	176	0
MAY										
04...	150	25	41	12	7.8	10	0.3	1.3	155	0
AUG										
31...	180	36	47	16	11	11	0.4	1.0	177	1

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
NOV										
13...	159	25	18	0.10	5.2	229	0.31	1290	<0.010	0.260
MAR										
16...	144	21	20	0.20	8.3	209	0.28	2200	<0.010	0.400
MAY										
04...	127	18	14	0.10	4.8	177	0.24	879	0.010	0.340
AUG										
31...	147	22	18	0.10	5.4	215	0.29	573	<0.010	0.110

04122030 MUSKEGON RIVER NEAR BRIDGETON, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV 13...	0.020	0.020	0.60	0.010	<0.010	<0.010	<10	1	22	<0.5
MAR 16...	0.100	0.090	0.60	0.020	--	<0.010	<10	1	20	<0.5
MAY 04...	0.020	0.030	0.40	0.010	<0.010	<0.010	10	1	18	<0.5
AUG 31...	0.020	0.020	0.50	0.030	0.010	<0.010	10	2	20	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV 13...	<1	<1	<3	2	10	<5	7	4	<0.1	<10
MAR 16...	<1	<1	<3	2	74	<5	<4	10	<0.1	<10
MAY 04...	<1	<1	<3	2	48	<5	14	5	<0.1	<10
AUG 31...	1	<1	<3	2	13	<5	6	6	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 13...	<1	<1	1.0	170	<6	5	35	198	19
MAR 16...	4	<1	<1.0	150	<6	13	40	421	16
MAY 04...	2	<1	<1.0	110	<6	15	13	65	44
AUG 31...	<1	<1	<1.0	160	<6	17	8	21	33

04122100 BEAR CREEK NEAR MUSKEGON, MI

LOCATION.--Lat 43°17'19", long 86°13'22", in SW1/4 NW1/4 sec.4, T.10 N., R.16 W., Muskegon County, Hydrologic Unit 04060102, on left bank at upstream side of bridge on North Getty Street, 1.5 mi upstream from Little Bear Creek, and 3.9 mi northeast of Muskegon.

DRAINAGE AREA.--14.8 mi².

PERIOD OF RECORD.--October 1965 to current year.

REVISED RECORDS.--WDR MI-80-1: 1976(M), 1978(M), 1979(P).

GAGE.--Water-stage recorder. Datum of gage is 590.00 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Natural Resources bench mark). Prior to Mar. 17, 1978, at different datum.

REMARKS.--Estimated daily discharges: Jan. 2, 4-12, 14, 15, 17-23 and Feb. 5-10, 12, 15-17, 21. Records good except for estimated daily discharges, which are poor. Some regulation during low flow by dams and irrigation upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 17.3 ft³/s, 15.87 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 930 ft³/s, Mar. 5, 1976, gage height, 11.00 ft, datum then in use; minimum, 1.0 ft³/s, Aug. 5, 17, 22, 1971.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 31	2300	*148	*14.38	Apr. 7	0030	101	13.49

Minimum discharge, 2.2 ft³/s, Aug. 4, 5, Sept. 11; minimum gage height, 10.15 ft, Aug. 4, 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	26	44	24	101	27	45	27	7.4	4.3	2.9	2.8
2	24	31	33	23	50	29	38	24	7.5	3.9	2.7	2.8
3	27	29	29	22	37	28	45	23	7.5	4.0	2.6	3.9
4	21	26	28	22	32	25	56	22	7.1	4.0	2.5	4.3
5	18	22	25	22	30	23	44	20	6.9	3.8	3.2	4.9
6	18	19	23	22	29	25	60	19	6.6	3.4	3.3	3.5
7	18	18	23	21	28	29	73	18	6.2	3.3	2.7	3.0
8	17	21	35	21	27	38	45	18	6.0	3.2	2.6	2.8
9	16	20	56	21	26	47	37	19	6.3	3.1	3.3	2.8
10	15	18	55	20	26	36	34	22	5.9	3.0	3.2	2.5
11	15	16	40	20	26	32	31	19	5.7	3.7	3.0	2.5
12	14	16	50	20	26	33	29	18	5.5	3.3	2.8	2.5
13	14	16	39	20	26	35	28	16	5.7	3.0	2.6	3.6
14	14	16	32	20	26	31	30	15	5.1	3.0	3.9	3.2
15	14	15	31	20	26	30	29	15	5.0	2.9	4.3	2.7
16	13	15	31	21	26	29	27	14	4.9	3.7	3.1	2.7
17	20	17	30	23	26	29	26	14	4.7	5.6	3.0	2.8
18	20	18	29	25	26	33	24	14	4.5	3.9	6.7	3.2
19	18	17	30	27	26	31	23	13	4.4	4.1	5.9	5.2
20	17	16	63	28	25	29	25	12	4.3	3.7	4.0	8.0
21	37	15	69	29	24	26	27	12	4.1	3.6	3.6	5.4
22	35	15	53	28	23	26	24	11	4.9	3.6	3.3	12
23	39	23	54	27	24	27	70	11	4.4	3.5	6.6	21
24	35	23	47	27	22	26	58	10	4.1	3.4	4.9	9.6
25	35	31	62	26	20	29	39	9.8	3.9	4.6	3.8	7.6
26	28	41	50	24	20	28	34	9.7	3.9	3.9	3.5	6.6
27	34	30	38	23	21	26	44	9.4	3.9	3.5	3.7	5.9
28	31	26	33	22	22	26	48	9.2	4.5	3.5	3.7	5.4
29	26	39	29	22	23	40	35	8.6	5.0	3.3	3.1	5.2
30	23	54	26	46	---	73	30	8.1	4.3	3.1	3.0	5.2
31	20	---	25	109	---	64	---	7.7	---	3.0	2.9	---
TOTAL	698	689	1212	825	844	1010	1158	468.5	160.2	111.9	110.4	153.6
MEAN	22.5	23.0	39.1	26.6	29.1	32.6	38.6	15.1	5.34	3.61	3.56	5.12
MAX	39	54	69	109	101	73	73	27	7.5	5.6	6.7	21
MIN	13	15	23	20	20	23	23	7.7	3.9	2.9	2.5	2.5
CFSM	1.52	1.55	2.64	1.80	1.97	2.20	2.61	1.02	.36	.24	.24	.35
IN.	1.75	1.73	3.05	2.07	2.12	2.54	2.91	1.18	.40	.28	.28	.39

CAL YR 1987 TOTAL 6282.6 MEAN 17.2 MAX 119 MIN 2.5 CFSM 1.16 IN 15.79
WTR YR 1988 TOTAL 7440.6 MEAN 20.3 MAX 109 MIN 2.5 CFSM 1.37 IN 18.70

04122200 WHITE RIVER NEAR WHITEHALL, MI

LOCATION.--Lat 43°27'51", long 86°13'57", in SE1/4 NW1/4 sec.4, T.12 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, on right bank 30 ft downstream from bridge on Fruitvale Road, 6.3 mi downstream from North Branch, and 6.9 mi northeast of Whitehall.

DRAINAGE AREA.--406 mi^2.

PERIOD OF RECORD.--August 1957 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 594.1 ft above National Geodetic Vertical Datum of 1929. Nov. 18, 1957, to Oct. 22, 1958, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 2 to Feb. 29. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 445 ft^3/s, 14.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,400 ft^3/s, Sept. 1, 1975, gage height, 7.46 ft; minimum, 163 ft^3/s, Aug. 18, 19, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,150 ft^3/s, Apr. 7, gage height, 4.84 ft; maximum gage height, 5.60 ft, Feb. 1, backwater from ice; minimum discharge, 209 ft^3/s, Aug. 5, gage height, 1.19 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	332	308	646	515	540	488	1010	589	327	260	231	228
2	355	336	687	515	780	490	923	543	324	254	225	224
3	392	303	650	515	760	493	883	515	318	250	218	240
4	378	302	601	510	730	481	912	498	320	246	214	259
5	347	302	541	510	640	465	960	486	314	242	213	325
6	327	307	492	505	580	474	922	468	311	238	230	337
7	320	326	470	480	530	499	1010	454	303	233	234	302
8	322	331	487	465	510	577	1080	445	296	230	223	268
9	317	342	572	470	520	721	922	452	298	227	236	253
10	313	361	679	475	530	999	843	495	299	225	261	241
11	312	365	812	475	530	924	780	530	296	230	262	235
12	311	365	782	475	520	856	711	514	292	231	249	232
13	309	358	761	480	520	856	652	484	287	232	238	258
14	302	350	728	490	510	870	620	460	284	227	233	263
15	298	346	665	500	500	809	604	446	277	227	238	247
16	302	337	611	490	500	750	600	437	275	266	227	238
17	303	359	578	475	500	688	593	429	272	306	218	240
18	306	375	561	490	500	635	571	419	272	300	258	250
19	307	386	555	515	500	617	548	410	268	283	313	288
20	305	380	596	540	500	600	532	401	266	265	293	358
21	303	371	687	570	500	570	525	397	260	269	265	379
22	303	360	834	570	490	542	519	400	272	300	247	394
23	305	381	800	550	480	548	565	397	322	272	270	487
24	305	437	760	500	460	560	660	385	302	261	287	531
25	305	464	724	480	445	606	764	369	280	271	273	476
26	304	496	757	475	450	657	742	366	265	270	253	384
27	303	541	767	460	460	703	721	362	258	264	244	339
28	302	508	698	455	470	686	686	354	260	254	250	314
29	303	503	622	455	480	671	674	345	271	244	245	297
30	303	573	559	470	---	724	639	339	268	237	238	287
31	303	---	535	500	---	936	---	335	---	236	234	---
TOTAL	9797	11473	20217	15375	15435	20495	22171	13524	8657	7850	7620	9174
MEAN	316	382	652	496	532	661	739	436	289	253	246	306
MAX	392	573	834	570	780	999	1080	589	327	306	313	531
MIN	298	302	470	455	445	465	519	335	258	225	213	224
CFSM	.78	.94	1.61	1.22	1.31	1.63	1.82	1.07	.71	.62	.61	.75
IN.	.90	1.05	1.85	1.41	1.41	1.88	2.03	1.24	.79	.72	.70	.84

CAL YR 1987 TOTAL 146412 MEAN 401 MAX 854 MIN 212 CFSM .99 IN 13.42
WTR YR 1988 TOTAL 161788 MEAN 442 MAX 1080 MIN 213 CFSM 1.09 IN 14.82

04122500 PERE MARQUETTE RIVER AT SCOTTVILLE, MI

LOCATION.--Lat 43°56'42", long 86°16'43", in NW1/4 NW1/4 sec.19, T.18 N., R.16 W., Mason County, Hydrologic Unit 04060101, on right bank 20 ft upstream from highway bridge at south edge of Scottville, 1.4 mi upstream from India Creek, and 5.6 mi downstream from Big South Branch.

DRAINAGE AREA.--681 mi².

PERIOD OF RECORD.--August 1939 to current year. Prior to October 1942, published as "at Custer".

REVISED RECORDS.--WSP 1437: 1941(M), 1943(M), 1949(M), 1950. WDR MI-81: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 597.66 ft above National Geodetic Vertical Datum of 1929. Prior to June 12, 1943, nonrecording gage at bridge 4.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Jan. 2-4 and Jan. 6 to Feb. 26. Records good except for estimated daily discharges, which are fair. Some regulation at low flow. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--49 years, 689 ft³/s, 13.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,440 ft³/s, Sept. 13, 1986, gage height, 8.07 ft; minimum, 209 ft³/s, Dec. 11, 1962, discharge measurement; minimum daily, 310 ft³/s, Aug. 9, 10, 1941.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,630 ft³/s, Apr. 6, gage height, 4.45 ft; maximum gage height, 5.21 ft, Feb. 4, backwater from ice; minimum discharge, 380 ft³/s, July 12, gage height, 1.40 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	578	681	972	832	900	774	1430	851	543	447	441	429
2	620	665	1060	840	1100	756	1510	810	536	443	431	420
3	641	681	1110	850	1250	753	1540	782	529	441	422	427
4	665	682	1070	840	1200	726	1490	759	523	433	415	486
5	664	672	989	832	1000	705	1460	732	516	427	422	564
6	629	651	912	830	950	720	1560	722	510	421	419	645
7	609	629	856	740	820	741	1620	700	507	414	420	599
8	587	625	848	750	830	825	1570	692	500	407	416	522
9	578	633	928	770	830	1100	1540	696	507	403	419	486
10	563	641	1030	780	850	1250	1440	737	507	403	429	464
11	551	639	1130	780	850	1380	1300	801	501	413	434	450
12	540	617	1210	780	830	1470	1200	844	492	421	428	443
13	535	602	1220	780	820	1510	1120	809	482	423	423	459
14	537	595	1150	800	820	1520	1050	763	473	412	438	453
15	535	590	1110	800	810	1450	990	727	466	409	429	441
16	531	590	1070	770	810	1320	951	712	461	441	427	431
17	559	598	991	780	810	1210	926	698	463	497	416	437
18	581	613	921	800	810	1130	902	660	463	486	434	447
19	594	624	897	860	820	1060	880	646	457	474	460	481
20	591	621	947	910	830	1010	851	640	449	455	460	520
21	653	612	1000	940	830	955	826	630	443	449	439	571
22	696	597	1090	920	810	888	810	627	452	459	428	615
23	748	616	1140	900	780	864	837	633	489	480	451	668
24	784	672	1130	780	800	884	870	621	503	491	467	688
25	802	729	1120	780	800	953	933	606	480	482	470	680
26	794	791	1120	760	790	1060	967	594	446	489	458	598
27	800	823	1120	740	777	1160	946	591	439	511	454	549
28	782	833	1090	730	773	1250	917	582	444	486	455	522
29	775	841	1010	730	769	1240	903	574	454	462	449	498
30	760	891	965	780	---	1230	899	562	457	446	442	483
31	713	---	866	800	---	1310	---	552	---	441	437	---
TOTAL	19995	20054	32072	24984	25069	33204	34238	21353	14492	13866	13533	15476
MEAN	645	668	1035	806	864	1071	1141	689	483	447	437	516
MAX	802	891	1220	940	1250	1520	1620	851	543	511	470	688
MIN	531	590	848	730	769	705	810	552	439	403	415	420
CFSM	.95	.98	1.52	1.18	1.27	1.57	1.68	1.01	.71	.66	.64	.76
IN.	1.09	1.10	1.75	1.36	1.37	1.81	1.87	1.17	.79	.76	.74	.85

CAL YR 1987 TOTAL 258360 MEAN 708 MAX 1240 MIN 384 CFSM 1.04 IN 14.11
WTR YR 1988 TOTAL 268336 MEAN 733 MAX 1620 MIN 403 CFSM 1.08 IN 14.66

04124000 MANISTEE RIVER NEAR SHERMAN, MI

LOCATION.--Lat 44°26'11", long 85°41'55", in NE1/4 NE1/4 sec.36, T.24 N., R.12 W., Wexford County, Hydrologic Unit 04060103, on downstream side of bridge near right pier on State Highway 37, 250 ft upstream from Wheeler Creek, 0.9 mi north of Sherman, and at mile 60.8.

DRAINAGE AREA.--857 mi², revised.

PERIOD OF RECORD.--July 1903 to May 1916, October 1930 to September 1931, October 1933 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1004: 1936(M). WSP 1307: 1911, 1913-14(M), 1934(M), 1936(M), 1937, 1939-40(M). WSP 1437: 1911, 1913(M), 1937.

GAGE.--Nonrecording gage. Elevation of gage is 804 ft, from river profile map. Prior to Apr. 13, 1934, at various datums.

REMARKS.--Estimated daily discharges: Dec. 15, 24, 25, Jan. 3-18, Feb. 4-16, June 12-15, 17-30, July 1-4 and Aug. 4, 5, 11-17. Records fair except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--68 years (water years 1904-15, 1931, 1934-88), 1,059 ft³/s, 16.78 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,570 ft³/s, Mar. 25, 1913, gage height, 7.1 ft, from graph based on gage readings, datum then in use; minimum daily, 540 ft³/s, Feb. 21-23, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge observed, 2,480 ft³/s, Apr. 7, gage height, 14.76 ft; minimum observed, 764 ft³/s, July 9, gage height, 10.82 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	954	990	1560	1060	1920	962	1900	1250	875	770	830	818
2	1000	990	1540	1040	1740	962	1960	1200	866	770	812	792
3	1050	990	1500	1020	1420	962	2100	1170	854	770	794	786
4	1020	998	1450	980	1350	958	2180	1130	845	770	800	780
5	994	1010	1320	960	1230	954	2220	1090	845	774	810	792
6	986	1010	1190	950	1180	946	2310	1070	845	772	824	848
7	986	998	1150	960	1150	946	2480	1050	845	770	833	830
8	1010	1010	1110	970	1150	1020	2280	1030	845	768	815	800
9	990	1060	1140	980	1160	1360	2050	1060	845	764	809	784
10	966	1080	1360	980	1160	1240	1870	1120	842	770	796	770
11	934	1070	1480	1000	1140	1220	1660	1070	839	796	790	770
12	890	1050	1490	1000	1120	1250	1520	1050	830	796	780	768
13	884	1030	1380	1010	1120	1230	1420	1040	820	790	770	772
14	881	1010	1330	1000	1110	1150	1350	1050	810	780	765	796
15	875	990	1320	1000	1110	1090	1290	1070	810	815	765	796
16	875	966	1310	1000	1110	1070	1300	1080	809	894	780	778
17	884	958	1270	1030	1110	1050	1280	1030	790	845	810	784
18	914	970	1210	1060	1160	1040	1250	982	790	824	800	776
19	906	990	1150	1160	1190	1030	1210	966	780	824	790	788
20	902	998	1150	1110	1100	1030	1210	958	780	821	780	839
21	902	1010	1150	1060	1020	1020	1180	950	850	812	772	842
22	910	1030	1150	1030	1050	1010	1150	942	920	830	766	845
23	894	1040	1160	1020	1080	994	1150	926	940	875	768	872
24	918	1050	1170	1030	1070	1110	1320	910	890	866	782	857
25	962	1070	1180	1040	1030	1290	1320	902	840	848	788	845
26	994	1120	1190	1050	1010	1600	1280	894	810	824	845	827
27	1020	1130	1150	1050	1000	1710	1290	890	790	812	857	812
28	1040	1140	1110	1040	994	1580	1350	894	780	798	872	794
29	1060	1150	1120	1050	978	1620	1330	898	770	788	890	786
30	1040	1370	1050	1070	---	1700	1280	898	765	809	851	786
31	1020	---	1030	1590	---	1860	---	884	---	851	845	---
TOTAL	29661	31278	38870	32300	33962	36964	47490	31454	24920	24996	24989	24133
MEAN	957	1043	1254	1042	1171	1192	1583	1015	831	806	806	804
MAX	1060	1370	1560	1590	1920	1860	2480	1250	940	894	890	872
MIN	875	958	1030	950	978	946	1150	884	765	764	765	768
CFSM	1.12	1.22	1.46	1.22	1.37	1.39	1.85	1.18	.97	.94	.94	.94
IN.	1.29	1.36	1.69	1.40	1.47	1.60	2.06	1.37	1.08	1.09	1.08	1.05

CAL YR 1987 TOTAL 373802 MEAN 1024 MAX 2160 MIN 738 CFSM 1.20 IN 16.23
WTR YR 1988 TOTAL 381017 MEAN 1041 MAX 2480 MIN 764 CFSM 1.22 IN 16.54

04126000 MANISTEE RIVER NEAR MANISTEE, MI

LOCATION.--Lat 44°16'14", long 86°11'56", in NW1/4 NW1/4 sec.36, T.22 N., R.16 W., Manistee County, Hydrologic Unit 04060103, on right bank 6.4 mi northeast of Manistee, 7.8 mi upstream from Manistee Lake, and at mile 10.8.

DRAINAGE AREA.--1,677 mi^2, revised.

PERIOD OF RECORD.--October 1951 to current year. Monthly discharge only for October, November, 1951, published in WSP 1727.

GAGE.--Water-stage recorder. Elevation of gage is 585 ft, from river-profile map.

REMARKS.--Estimated daily discharges: Jan. 5-20 and Feb. 7-19. Records good except for estimated daily discharges, which are fair. Flow regulated at all stages by Tippy Hydroelectric Powerplant 21 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--37 years, 2,035 ft^3/s, 16.48 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,280 ft^3/s, Oct. 5, 1986, gage height, 8.44 ft; maximum gage height, 9.25 ft, Dec. 28, 1985, backwater from ice; minimum daily discharge, 570 ft^3/s, June 18, 1980.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,940 ft^3/s, Apr. 7, gage height, 7.91 ft; maximum gage height, 8.84 ft, Feb. 10, backwater from ice; minimum discharge, 1,080 ft^3/s, Aug. 8, 20, gage height, 4.38 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1870	2220	2620	1930	3230	1990	3380	2310	1790	1570	1480	1580
2	2170	1450	2920	2160	3600	1970	3330	2250	1730	1560	1530	1760
3	2460	2240	3150	1870	3730	1990	3350	2400	1640	1480	1470	1550
4	1740	2150	3200	2380	3620	1930	3380	2290	1790	1470	1820	1420
5	2020	2150	2730	2750	3300	1830	3410	2140	1710	1470	1870	1530
6	2100	2290	2370	2350	3060	1960	3570	2060	1620	1470	1480	1550
7	2150	2250	2130	1600	1700	1920	3710	1990	1620	1460	1200	1630
8	2030	2190	2450	1380	2000	2100	3900	2080	1710	1490	1160	1630
9	2120	1540	2620	1560	2300	2490	3610	1990	1700	1900	1730	1630
10	1830	2260	2820	1700	2400	3050	3520	2130	1730	1170	1630	1580
11	1820	2170	3010	1950	1800	3060	3240	2260	1620	1420	1550	1460
12	1880	2150	3190	2200	2200	3010	2950	2120	1640	1600	1600	1460
13	1840	1920	2950	1950	2250	2640	2830	2120	1680	1550	1700	1530
14	1930	2180	2800	2300	2100	2740	2760	2580	1590	1540	1400	1470
15	1910	1790	2870	2100	2050	2570	2730	1960	1590	1530	1400	1550
16	1750	1570	2900	2000	2300	2600	2720	1820	1600	1580	1550	1480
17	1940	2290	2550	2050	2400	2520	2740	2070	1640	1710	1560	1560
18	2100	1980	2350	1800	2150	2260	1870	2070	1500	1830	1740	1560
19	2380	1940	2500	2300	2200	2350	2750	1940	1570	1580	1550	1570
20	2810	2160	2130	2900	2610	2100	2500	1900	1570	1560	1200	2170
21	3020	2330	2400	3130	2690	1860	2280	1910	1560	1560	1420	1630
22	1910	1610	2370	2690	2290	2230	2260	1910	1640	1600	1390	1670
23	1400	1760	2660	1960	3310	2050	2400	1660	1730	1880	1370	1780
24	1480	2270	2360	2470	2030	2240	2560	1900	1700	1640	1550	1800
25	1450	2160	2700	2180	1890	2710	2460	2230	1760	1400	1600	1650
26	1390	2330	2640	1950	2260	2910	2540	1780	1690	1650	1610	1780
27	2000	2510	2350	2340	1970	3140	2400	1500	1590	1620	1540	1650
28	2440	2120	2120	2120	1790	3180	2490	1780	1580	1640	1580	1580
29	2410	2290	2430	2010	1860	3150	2600	1960	1570	1520	1780	1500
30	2270	2470	2130	2160	---	3240	2630	1870	1580	1400	1610	1550
31	2390	---	2430	2830	---	3360	---	1720	---	1710	1540	---
TOTAL	63010	62740	80850	67070	71090	77150	86870	62700	49440	48560	47610	48260
MEAN	2033	2091	2608	2164	2451	2489	2896	2023	1648	1566	1536	1609
MAX	3020	2510	3200	3130	3730	3360	3900	2580	1790	1900	1870	2170
MIN	1390	1450	2120	1380	1700	1830	1870	1500	1500	1170	1160	1420
CFSM	1.21	1.25	1.56	1.29	1.46	1.48	1.73	1.21	.98	.93	.92	.96
IN.	1.40	1.39	1.79	1.49	1.58	1.71	1.93	1.39	1.10	1.08	1.06	1.07

CAL YR 1987 TOTAL 730050 MEAN 2000 MAX 5210 MIN 1050 CFSM 1.19 IN 16.19
WTR YR 1988 TOTAL 765350 MEAN 2091 MAX 3900 MIN 1160 CFSM 1.25 IN 16.98

04126520 MANISTEE RIVER AT MANISTEE, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°15'02", long 86°19'09", in SW1/4 SW1/4 sec.1, T.21 N., R.17 W., Manistee County, Hydrologic Unit 04060103, at upstream side of bridge on U.S. Highway 31 in Manistee, and 1.3 mi upstream from mouth.

DRAINAGE AREA.--1,928 mi², revised.

PERIOD OF RECORD.--Water years 1974 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Mar. 18, 1977 to Sept. 30, 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at Washington Street bridge. Water-discharge measurements were made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-81): Maximum daily, 1,680 microsiemens, Nov. 18, 1974; minimum, 226 microsiemens, Apr. 22, 1980.
WATER TEMPERATURE (water years 1975-81): Maximum, 26.5°C, July 8, 1981, minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
20...	0900	2510	502	8.06	5.0	3.2	11.7	94	100	44
JAN										
07...	1000	--	470	7.72	0.0	3.7	13.8	95	K13	60
MAR										
22...	1130	3260	403	7.97	2.0	3.1	12.6	93	K3	K9
MAY										
05...	1000	2480	402	8.17	11.5	3.1	10.2	96	K4	K56
JUL										
06...	1330	2260	464	8.15	23.0	3.6	7.3	87	120	K50
SEP										
01...	0930	2750	--	8.19	20.5	1.4	8.2	93	120	73

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
20...	200	57	60	13	15	14	0.5	1.5	178	0
JAN										
07...	180	39	54	12	14	14	0.5	1.7	176	0
MAR										
22...	180	37	53	12	9.9	11	0.3	1.2	177	0
MAY										
05...	180	41	53	12	13	13	0.4	1.3	172	0
JUL										
06...	200	48	58	13	13	12	0.4	1.2	182	0
SEP										
01...	210	60	60	15	13	12	0.4	1.2	185	0

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
NOV										
20...	146	15	48	0.10	8.0	262	0.36	1780	<0.010	0.210
JAN										
07...	145	14	46	0.20	8.6	249	0.34	--	0.020	0.270
MAR										
22...	145	13	29	0.10	8.3	224	0.30	1970	<0.010	0.270
MAY										
05...	141	15	38	0.20	6.7	220	0.30	1470	0.010	0.140
JUL										
06...	150	17	41	0.10	6.5	258	0.35	1570	<0.010	0.120
SEP										
01...	152	15	43	0.20	6.2	249	0.34	1850	<0.010	0.210

04126520 MANISTEE RIVER AT MANISTEE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV										
20...	0.060	0.070	0.70	0.010	0.010	0.010	10	1	18	<0.5
JAN										
07...	0.090	0.090	0.60	0.020	<0.010	<0.010	--	--	--	--
MAR										
22...	0.030	0.030	0.30	<0.010	<0.010	<0.010	<10	<1	22	<0.5
MAY										
05...	0.020	0.040	<0.20	0.010	<0.010	<0.010	30	1	18	<0.5
JUL										
06...	0.040	0.040	0.50	0.020	0.010	0.010	--	--	--	--
SEP										
01...	0.040	0.040	0.30	0.030	0.010	<0.010	10	1	20	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV										
20...	<1	<1	<3	3	54	<5	12	5	<0.1	<10
JAN										
07...	--	--	--	--	--	--	--	--	--	--
MAR										
22...	<1	<1	<3	2	39	<5	14	10	<0.1	<10
MAY										
05...	<1	<1	<3	2	73	<5	21	10	<0.1	<10
JUL										
06...	--	--	--	--	--	--	--	--	--	--
SEP										
01...	2	<1	<3	1	11	<5	16	1	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV									
20...	<1	<1	<1.0	340	<6	13	10	68	81
JAN									
07...	--	--	--	--	--	--	12	--	49
MAR									
22...	<1	<1	1.0	250	<6	4	16	141	64
MAY									
05...	4	<1	<1.0	290	<6	4	5	33	100
JUL									
06...	--	--	--	--	--	--	5	31	100
SEP									
01...	<1	<1	<1.0	360	<6	24	14	104	70

04127000 BOARDMAN RIVER NEAR MAYFIELD, MI

LOCATION.--Lat 44°38'18", long 85°31'10", in SE1/4 NE1/4 sec.21, T.26 N., R.10 W., Grand Traverse County, Hydrologic Unit 04060105, on right bank 25 ft downstream from Brown's Bridge, 300 ft downstream from East Creek, 0.9 mi downstream from Brown's Bridge Dam, 1.0 mi northeast of Mayfield, and 9.6 mi southeast of Traverse City.

DRAINAGE AREA.--182 mi^2.

PERIOD OF RECORD.--June 1952 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 757.89 ft above National Geodetic Vertical Datum of 1929 (Traverse City Light and Power bench mark).

REMARKS.--No estimated daily discharges. Records good. Flow regulated by hydroelectric powerplant 0.9 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--36 years, 196 ft^3/s, 14.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,220 ft^3/s, Sept. 14, 1961, gage height, 6.90 ft; minimum, 30 ft^3/s, Jan. 15, 1965, gage height, 2.53 ft; minimum daily, 47 ft^3/s, Nov. 2, 3, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 591 ft^3/s, Apr. 4, gage height, 5.13 ft; minimum, 101 ft^3/s, June 1, gage height, 2.97 ft; minimum daily, 119 ft^3/s, Sept. 17.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	204	220	378	221	348	187	378	284	193	152	178	156
2	225	208	302	218	280	189	364	214	185	150	168	140
3	223	202	266	184	242	197	444	228	160	152	152	142
4	221	202	271	227	246	201	508	216	178	148	134	163
5	227	203	240	193	238	201	507	231	178	172	131	179
6	229	201	230	185	208	200	489	194	178	171	131	172
7	277	200	229	199	198	157	480	235	176	159	143	166
8	261	207	239	210	217	248	442	216	176	148	148	146
9	223	226	332	215	217	287	336	262	177	144	145	145
10	207	231	331	206	221	234	326	184	174	147	149	146
11	212	259	367	191	216	247	323	189	173	165	157	146
12	218	230	304	166	201	276	230	259	173	169	146	156
13	191	214	289	189	201	225	283	244	172	173	141	197
14	180	206	262	197	201	220	286	209	172	177	149	197
15	195	204	270	207	202	220	263	208	172	195	176	167
16	193	204	257	213	200	218	245	208	156	211	185	142
17	201	202	234	209	199	216	240	208	159	193	168	119
18	211	229	282	210	208	217	264	206	149	169	154	137
19	201	252	220	276	210	216	270	228	150	158	147	196
20	199	255	272	202	210	185	252	239	160	157	158	193
21	200	210	225	229	177	178	241	236	170	170	137	165
22	212	208	281	220	218	215	243	196	179	180	141	155
23	208	200	195	223	211	234	254	193	175	178	140	212
24	210	202	244	221	208	197	285	203	173	177	134	152
25	211	232	263	205	194	370	287	186	169	177	175	151
26	208	262	250	196	193	367	286	172	172	179	207	172
27	218	239	248	197	193	340	265	187	171	176	237	162
28	220	216	223	197	193	297	258	197	171	163	214	162
29	213	225	219	205	195	310	281	194	154	144	175	149
30	214	314	222	228	---	363	288	191	151	149	176	144
31	221	---	219	330	---	355	---	188	---	169	176	---
TOTAL	6633	6665	8164	6569	6245	7567	9618	6605	5096	5172	4972	4829
MEAN	214	222	263	212	215	244	321	213	170	167	160	161
MAX	277	314	378	330	348	370	508	284	193	211	237	212
MIN	180	200	195	166	177	157	230	172	149	144	131	119
CFSM	1.18	1.22	1.45	1.17	1.18	1.34	1.76	1.17	.93	.92	.88	.89
IN.	1.36	1.36	1.67	1.34	1.28	1.55	1.97	1.35	1.04	1.06	1.02	.99

CAL YR 1987 TOTAL 77472 MEAN 212 MAX 857 MIN 125 CFSM 1.17 IN 15.83
WTR YR 1988 TOTAL 78135 MEAN 213 MAX 508 MIN 119 CFSM 1.17 IN 15.97

445256085240001 ELK LAKE NEAR ELK RAPIDS, MI

LOCATION.--Lat 44°50'43", long 85°23'33", in SW1/4 SW1/4 sec.3, T.28 N., R.9 W., Grand Traverse County, Hydrologic Unit 04060105, at Gay Road, 3.5 mi south of Elk Rapids.

DRAINAGE AREA.--410 mi^2, approximately.

PERIOD OF RECORD.--October 1951 to current year.

GAGE.--Water-stage recorder. Datum of gage is 586.25 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to June 20, 1952, nonrecording gage at same datum.

REMARKS.--Elk Lake is at the end of a long chain of interconnected lakes and is contiguous with Lake Skegemog. The major inlet to these lakes is Torch River. Smaller inlets include Williamsburg, Battle, Barker, and Desmond Creeks. The outlet of Elk Lake is Elk River. Lake elevation controlled by dam at Elk Rapids. Maximum depth 192 ft, surface area 7,930 acres. Established legal level; summer, 589.50 ft, winter, 588.90 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.88 ft, Oct. 6, 1986; minimum, 2.08 ft, Dec. 30, 31, 1981.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.39 ft, May 9; minimum, 2.58 ft, Nov. 17, 19.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.12	2.72	2.83	2.66	2.71	2.65	2.72	3.29	3.09	3.08	3.09	3.12
2	3.17	2.66	2.80	2.67	2.70	2.66	2.70	3.30	3.07	3.08	3.09	3.11
3	3.23	2.66	2.76	2.70	2.68	2.66	2.73	3.30	3.04	3.09	3.10	3.12
4	3.24	2.66	2.73	2.71	2.67	2.66	2.78	3.31	3.04	3.09	3.10	3.14
5	3.24	2.66	2.75	2.74	2.66	2.65	2.78	3.31	3.03	3.11	3.10	3.14
6	3.24	2.69	2.75	2.77	2.67	2.65	2.83	3.31	3.02	3.10	3.08	3.12
7	3.26	2.68	2.71	2.76	2.72	2.64	2.86	3.33	3.02	3.08	3.09	3.11
8	3.20	2.71	2.70	2.74	2.76	2.66	2.87	3.32	3.02	3.06	3.08	3.09
9	3.12	2.72	2.74	2.73	2.80	2.68	2.90	3.34	3.00	3.06	3.10	3.08
10	3.10	2.70	2.75	2.71	2.83	2.69	2.93	3.36	3.00	3.08	3.11	3.07
11	3.11	2.67	2.75	2.70	2.84	2.69	2.96	3.34	3.02	3.12	3.11	3.08
12	3.11	2.66	2.76	2.68	2.87	2.68	2.99	3.31	3.04	3.11	3.10	3.08
13	3.07	2.64	2.74	2.69	2.88	2.72	3.00	3.28	3.06	3.09	3.10	3.11
14	3.02	2.62	2.71	2.68	2.89	2.71	3.02	3.25	3.06	3.15	3.08	3.11
15	2.97	2.61	2.74	2.69	2.91	2.69	3.04	3.20	3.07	3.14	3.07	3.12
16	2.94	2.60	2.76	2.71	2.90	2.67	3.05	3.16	3.08	3.13	3.10	3.11
17	2.96	2.60	2.79	2.73	2.87	2.65	3.06	3.15	3.08	3.12	3.11	3.11
18	2.97	2.62	2.76	2.75	2.83	2.64	3.07	3.16	3.08	3.11	3.10	3.11
19	2.98	2.62	2.75	2.75	2.77	2.65	3.09	3.16	3.07	3.10	3.08	3.15
20	2.97	2.64	2.78	2.79	2.75	2.65	3.13	3.16	3.07	3.09	3.07	3.15
21	2.97	2.66	2.74	2.79	2.73	2.65	3.16	3.17	3.09	3.13	3.07	3.15
22	2.97	2.61	2.73	2.79	2.73	2.65	3.15	3.17	3.16	3.14	3.07	3.17
23	2.97	2.60	2.73	2.78	2.70	2.65	3.17	3.17	3.14	3.14	3.08	3.17
24	2.96	2.62	2.73	2.77	2.67	2.65	3.19	3.15	3.08	3.12	3.09	3.17
25	2.95	2.68	2.73	2.77	2.66	2.64	3.20	3.14	3.04	3.11	3.13	3.16
26	2.93	2.73	2.71	2.74	2.64	2.64	3.19	3.13	3.03	3.08	3.14	3.16
27	2.92	2.75	2.68	2.70	2.62	2.64	3.20	3.13	3.05	3.07	3.14	3.14
28	2.90	2.74	2.69	2.68	2.61	2.63	3.24	3.12	3.06	3.05	3.14	3.14
29	2.90	2.76	2.68	2.66	2.62	2.64	3.25	3.11	3.07	3.05	3.14	3.12
30	2.85	2.81	2.67	2.64	---	2.73	3.27	3.10	3.07	3.08	3.14	3.12
31	2.78	---	2.65	2.67	---	2.73	---	3.09	---	3.10	3.14	---
MEAN	3.04	2.67	2.74	2.72	2.75	2.66	3.02	3.22	3.06	3.10	3.10	3.12
MAX	3.26	2.81	2.83	2.79	2.91	2.73	3.27	3.36	3.16	3.15	3.14	3.17
MIN	2.78	2.60	2.65	2.64	2.61	2.63	2.70	3.09	3.00	3.05	3.07	3.07

WTR YR 1988 MEAN 2.93 MAX 3.36 MIN 2.60

04127800 JORDAN RIVER NEAR EAST JORDAN, MI

LOCATION.--Lat 45°06'09", long 85°05'53", in NW1/4 NW1/4 sec.7, T.31 N., R.6 W., Antrim County, Hydrologic Unit 04060105, on right bank 300 ft downstream from Webster Bridge, 4.2 mi south of East Jordan, and 4.5 mi upstream from mouth.

DRAINAGE AREA.--67.9 mi².

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1960-65. October 1966 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 596.43 ft above National Geodetic Vertical Datum of 1929 (Antrim County Road Commission bench mark). Nov. 19, 1959 to Sept. 30, 1966, nonrecording gage at present site and at site 600 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Dec. 30, Jan. 2, 5-12, 14, 15, 27-29 and Feb. 3, 5-15. Records good except for estimated daily discharges, which are fair. Some regulation at low flow by fish hatchery upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 188 ft³/s, 37.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,360 ft³/s, July 19, 1975, gage height, 6.51 ft; minimum, 91 ft³/s, Mar. 8, 1982, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 25	2300	472	4.84	Apr. 6	1700	574	5.14
Apr. 4	1000	*701	*5.47				

Minimum discharge, 137 ft³/s, Mar. 1, gage height, 2.91 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	178	173	212	182	281	173	272	189	170	158	157	161
2	237	175	191	180	215	177	277	186	168	157	155	158
3	191	196	186	179	200	172	391	184	166	156	153	161
4	174	197	183	180	189	174	588	184	166	155	155	167
5	171	203	186	179	185	172	320	183	166	154	159	180
6	178	193	178	179	180	173	469	182	166	153	157	166
7	202	190	176	179	178	177	337	181	164	152	153	162
8	194	231	196	179	178	191	249	180	170	152	154	159
9	175	204	269	178	178	252	227	184	171	152	163	159
10	170	183	251	178	178	210	217	194	169	160	162	157
11	169	177	206	179	178	203	212	185	167	169	155	157
12	168	177	220	179	178	208	207	184	164	157	154	160
13	167	176	226	180	177	194	204	205	162	156	153	162
14	167	174	203	179	177	186	207	190	162	187	156	164
15	167	173	199	178	176	182	203	184	162	162	152	161
16	167	173	202	177	175	180	205	183	162	175	213	158
17	201	176	192	195	176	179	203	181	162	163	183	166
18	189	184	189	190	176	181	214	179	161	162	163	161
19	173	182	190	183	178	179	201	178	159	168	157	170
20	169	183	203	191	178	175	199	179	158	159	156	181
21	168	178	201	185	178	175	194	182	158	165	155	173
22	173	176	193	185	178	175	191	178	217	177	154	167
23	194	198	189	181	179	186	213	175	174	171	162	173
24	190	216	190	177	176	213	242	174	164	167	180	163
25	181	189	212	177	176	334	209	175	164	161	189	161
26	174	183	194	175	175	341	198	181	160	159	219	160
27	196	179	185	170	174	241	204	186	159	158	173	167
28	190	179	182	165	175	211	219	176	160	163	198	162
29	194	205	178	175	177	301	197	176	159	160	169	160
30	183	299	178	186	---	334	192	173	158	170	163	160
31	175	---	179	296	---	266	---	171	---	160	161	---
TOTAL	5625	5722	6139	5696	5319	6515	7461	5642	4968	5018	5133	4916
MEAN	181	191	198	184	183	210	249	182	166	162	166	164
MAX	237	299	269	296	281	341	588	205	217	187	219	181
MIN	167	173	176	165	174	172	191	171	158	152	152	157
CFSM	2.67	2.81	2.92	2.71	2.70	3.09	3.67	2.68	2.45	2.39	2.45	2.42
IN.	3.08	3.13	3.36	3.12	2.91	3.57	4.09	3.09	2.72	2.75	2.81	2.69

CAL YR 1987 TOTAL 65425 MEAN 179 MAX 376 MIN 153 CFSM 2.64 IN 35.84
WTR YR 1988 TOTAL 68154 MEAN 186 MAX 588 MIN 152 CFSM 2.74 IN 37.34

04127918 PINE RIVER NEAR RUDYARD, MI

LOCATION.--Lat 46°11'09", long 84°35'52", in NW1/4 NE1/4 sec.30, T.44 N., R.2 W., Chippewa County, Hydrologic Unit 04070002, on right bank 15 ft upstream from county highway bridge, 3.2 mi south of Rudyard.

DRAINAGE AREA.--184 mi^2.

PERIOD OF RECORD.--April 1972 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 600 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Aug. 4, 1972, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 3-8 and Dec. 16 to Apr. 5. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--16 years, 234 ft^3/s, 17.27 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,500 ft^3/s, Mar. 30, 1986, gage height, 18.44 ft; minimum, 51 ft^3/s, July 29, Aug. 14, 1987; minimum gage height, 1.83 ft, July 29, 30, 1982.

EXTREMES OUTSIDE PERIOD OF RECORD.--A discharge of 50.3 ft^3/s was measured Aug. 6, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov. 23	2400	1,450	7.89	Apr. 6	1800	*3,890	15.79
Apr. 5	0200	ice jam	*16.92				

Minimum discharge, 52 ft^3/s, July 9-11, gage height, 1.93 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	137	167	547	125	110	79	1200	221	100	60	65	107
2	350	156	353	115	110	79	1600	207	105	59	82	97
3	323	156	275	107	107	80	2500	198	110	59	70	91
4	256	293	265	103	105	82	3000	186	99	59	64	94
5	205	337	260	100	100	85	3200	179	94	58	62	98
6	178	298	250	98	98	90	3540	167	89	55	65	97
7	174	272	240	96	96	95	3170	157	84	53	66	93
8	185	247	225	94	93	100	2390	148	83	54	68	86
9	163	223	548	93	91	105	1690	143	83	52	119	83
10	147	205	846	93	89	110	1230	142	80	52	113	78
11	132	193	545	93	88	115	950	143	79	54	89	74
12	123	182	562	94	87	115	786	137	78	55	76	72
13	116	171	424	98	86	115	677	357	75	57	70	79
14	108	170	325	97	86	115	576	271	74	62	90	84
15	110	161	255	96	85	115	475	291	71	66	107	78
16	110	154	205	100	84	115	422	298	68	86	91	74
17	323	177	200	110	84	115	398	223	68	91	105	71
18	639	231	195	115	85	112	371	188	68	73	147	71
19	390	212	195	115	86	110	337	173	68	66	118	74
20	297	215	195	120	87	108	342	149	70	63	98	131
21	259	131	195	120	88	105	297	145	72	61	84	154
22	245	232	190	120	86	105	271	136	68	60	73	134
23	251	325	190	115	85	110	267	124	68	60	70	133
24	256	532	185	110	85	120	395	114	65	59	71	125
25	260	333	175	105	84	200	342	107	66	58	82	111
26	232	256	175	100	83	450	368	103	68	56	92	105
27	226	266	170	98	82	500	322	105	66	56	93	132
28	222	204	150	97	81	470	288	107	63	56	137	136
29	207	290	140	96	80	560	262	104	62	55	150	121
30	192	675	135	100	---	665	244	96	61	56	137	113
31	179	---	135	105	---	770	---	105	---	58	123	---
TOTAL	6995	7464	8750	3228	2611	6095	31910	5224	2305	1869	2877	2996
MEAN	226	249	282	104	90.0	197	1064	169	76.8	60.3	92.8	99.9
MAX	639	675	846	125	110	770	3540	357	110	91	150	154
MIN	108	131	135	93	80	79	244	96	61	52	62	71
CFSM	1.23	1.35	1.53	.57	.49	1.07	5.78	.92	.42	.33	.50	.54
IN.	1.41	1.51	1.77	.65	.53	1.23	6.45	1.06	.47	.38	.58	.61

CAL YR 1987 TOTAL 61730 MEAN 169 MAX 1370 MIN 53 CFSM .92 IN 12.48
WTR YR 1988 TOTAL 82324 MEAN 225 MAX 3540 MIN 52 CFSM 1.22 IN 16.64

452600084472001 CROOKED LAKE NEAR CONWAY, MI

LOCATION.--Lat 45°23'52", long 84°49'22", in NE1/4 SW1/4 sec.29, T.35 N., R.4 W., Emmet County, Hydrologic Unit 04070004, at Minnehaha Creek Inlet on Channel Road, 2.5 mi southeast of Conway.

DRAINAGE AREA.--101 mi².

PERIOD OF RECORD.--June 1942 to July 1945 (summer months only), August 1945 to current year.

GAGE.--Water-stage recorder. Datum of gage is 593.38 ft above National Geodetic Vertical Datum of 1929. Prior to June 13, 1960, nonrecording gage at datum 1.00 ft higher. June 13, 1960 to June 29, 1964, nonrecording gage at same datum.

REMARKS.--Crooked Lake is the upstream end of the navigable inland water route. Major inlets are Minnehaha Creek, Round Lake Outlet, and Pickerel Lake Outlet. The outlet is Crooked River. Lake elevation controlled by dam and boat lock at Alanson. Maximum depth 68 ft, surface area 2,400 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.60 ft, Apr. 12, 1948 (present datum); minimum, 0.54 ft, Mar. 30, 1982.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 2.67 ft, Apr. 28; minimum, 0.97 ft, Mar. 8.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.41	2.37	1.71	1.47	1.39	1.13	1.57	2.59	2.30	2.14	2.21	2.32
2	2.48	2.37	1.66	1.49	1.51	1.10	1.61	2.57	2.30	2.13	2.21	2.31
3	2.46	2.43	1.62	1.44	1.48	1.09	1.74	2.55	2.28	2.13	2.19	2.31
4	2.42	2.48	1.59	1.46	1.47	1.08	1.98	2.52	2.26	2.13	2.20	2.31
5	2.41	2.52	1.55	1.48	1.45	1.05	2.10	2.50	2.24	2.13	2.22	2.29
6	2.40	2.48	1.50	1.48	1.45	1.03	2.26	2.49	2.24	2.13	2.20	2.26
7	2.42	2.46	1.47	1.49	1.45	1.00	2.35	2.47	2.24	2.13	2.19	2.25
8	2.40	2.46	1.45	1.48	1.45	1.02	2.36	2.44	2.25	2.13	2.17	2.24
9	2.36	2.44	1.49	1.49	1.43	1.12	2.40	2.43	2.25	2.13	2.18	2.23
10	2.35	2.43	1.51	1.49	1.41	1.13	2.43	2.44	2.23	2.13	2.19	2.22
11	2.34	2.40	1.51	1.48	1.40	1.13	2.44	2.44	2.22	2.13	2.18	2.22
12	2.33	2.40	1.52	1.45	1.41	1.16	2.46	2.43	2.22	2.13	2.18	2.25
13	2.32	2.39	1.52	1.45	1.40	1.21	2.45	2.46	2.22	2.12	2.18	2.31
14	2.30	2.38	1.57	1.44	1.39	1.20	2.47	2.48	2.21	2.12	2.16	2.30
15	2.31	2.38	1.65	1.44	1.38	1.18	2.46	2.46	2.20	2.15	2.15	2.29
16	2.31	2.37	1.72	1.42	1.35	1.16	2.46	2.46	2.20	2.19	2.20	2.28
17	2.36	2.35	1.69	1.38	1.30	1.15	2.46	2.44	2.20	2.19	2.29	2.28
18	2.37	2.35	1.66	1.37	1.27	1.15	2.49	2.43	2.20	2.21	2.30	2.28
19	2.37	2.35	1.64	1.36	1.25	1.14	2.47	2.42	2.17	2.26	2.27	2.30
20	2.36	2.34	1.66	1.40	1.30	1.14	2.47	2.41	2.17	2.25	2.26	2.33
21	2.36	2.22	1.64	1.42	1.33	1.14	2.46	2.40	2.18	2.24	2.25	2.34
22	2.36	2.10	1.62	1.43	1.23	1.10	2.46	2.39	2.20	2.24	2.24	2.33
23	2.37	2.02	1.60	1.43	1.21	1.07	2.49	2.38	2.19	2.23	2.24	2.32
24	2.38	1.95	1.58	---	1.19	1.05	2.52	2.37	2.20	2.22	2.27	2.31
25	2.37	1.89	1.59	---	1.20	1.12	2.52	2.33	2.20	2.21	2.31	2.30
26	2.36	1.82	1.57	---	1.16	1.25	2.52	2.32	2.18	2.21	2.33	2.30
27	2.38	1.76	1.55	---	1.15	1.31	2.57	2.33	2.16	2.20	2.32	2.30
28	2.38	1.71	1.52	1.34	1.14	1.30	2.64	2.33	2.16	2.20	2.36	2.30
29	2.39	1.69	1.50	1.33	1.14	1.38	2.63	2.33	2.16	2.19	2.36	2.28
30	2.39	1.72	1.48	1.33	---	1.51	2.61	2.32	2.15	2.22	2.35	2.28
31	2.38	---	1.46	1.33	---	1.54	---	2.31	---	2.21	2.34	---
MEAN	2.37	2.23	1.57	---	1.33	1.17	2.36	2.43	2.21	2.18	2.24	2.29
MAX	2.48	2.52	1.72	---	1.51	1.54	2.64	2.59	2.30	2.26	2.36	2.34
MIN	2.30	1.69	1.45	---	1.14	1.00	1.57	2.31	2.15	2.12	2.15	2.22

CAL YR 1987 MEAN 1.86 MAX 2.52 MIN .92

04128000 STURGEON RIVER NEAR WOLVERINE, MI

LOCATION.--Lat 45°17'56", long 84°36'40", in SE1/4 NE1/4 sec.36, T.34 N., R.3 W., Cheboygan County, Hydrologic Unit 04070004, on left bank 1.8 mi north of Wolverine, 2.8 mi downstream from West Branch, and 9 mi upstream from mouth.

DRAINAGE AREA.--198 mi².

PERIOD OF RECORD.--April 1942 to current year.

REVISED RECORDS.--WSP 1307: 1944(M), 1948(M). WSP 1727: 1951(M). WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 15, 1942, nonrecording gage at site 1.0 mi upstream, and June 16, 1942, to Sept. 30, 1958, at site 0.7 mi upstream at different datums.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 4, 6-18, 22, 23, 27-29, Feb. 4, 7-10, 12-18, 22, 25, 26 and Mar. 2, 3, 5, 6, 22. Records good except for estimated daily discharges, which are poor. Prior to July 1975, intermittent regulation at low flows by ponds 2.4 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 220 ft³/s, 15.09 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,290 ft³/s, Sept. 29, 1972, gage height, 3.72 ft; maximum gage height, 4.48 ft, Sept. 14, 1961; minimum discharge, 94 ft³/s, Jan. 19, 1971, result of freezeup; minimum daily, 113 ft³/s, Aug. 6, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 772 ft³/s, Apr. 4, gage height, 2.98 ft; minimum, 109 ft³/s, Mar. 21, gage height, 1.29 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	224	214	296	216	378	192	364	247	185	161	159	176
2	260	214	246	210	283	190	377	232	181	160	156	171
3	267	224	234	205	239	187	522	223	179	158	154	169
4	223	255	227	190	237	185	726	217	180	156	154	178
5	210	266	222	179	235	188	574	210	176	158	211	184
6	206	247	215	180	223	191	512	205	175	153	186	179
7	222	235	210	182	220	195	487	207	172	150	164	173
8	231	238	221	185	215	209	392	205	180	148	159	169
9	219	269	296	188	214	276	326	204	190	146	165	166
10	211	237	322	190	213	254	317	219	180	152	180	161
11	207	224	279	192	212	236	291	217	174	168	165	163
12	203	217	281	195	210	234	275	211	171	160	157	165
13	200	217	282	198	210	231	262	245	168	156	156	194
14	196	215	256	202	210	221	259	243	165	169	166	182
15	193	212	250	205	210	219	255	223	159	170	162	171
16	191	211	257	210	209	212	252	213	164	183	165	170
17	208	211	249	215	209	206	252	209	165	174	185	169
18	229	214	240	220	209	209	269	204	162	171	174	173
19	211	214	237	225	209	206	249	200	160	185	164	174
20	202	220	244	227	208	203	240	202	159	170	159	189
21	197	211	244	224	206	186	236	201	157	166	158	194
22	196	204	237	220	206	200	235	198	226	180	154	185
23	214	218	233	217	205	208	246	196	228	175	158	183
24	223	238	230	216	202	237	309	191	181	173	193	179
25	226	230	242	211	200	320	304	188	177	167	299	171
26	213	222	240	209	199	430	261	191	169	169	283	170
27	224	217	228	200	198	349	279	212	165	163	221	177
28	235	220	223	195	196	273	361	201	165	162	214	179
29	234	272	214	220	199	345	292	195	163	163	195	172
30	229	350	214	249	---	442	258	189	161	173	189	176
31	219	---	215	323	---	376	---	184	---	166	181	---
TOTAL	6723	6936	7584	6498	6364	7610	9982	6482	5237	5105	5586	5262
MEAN	217	231	245	210	219	245	333	209	175	165	180	175
MAX	267	350	322	323	378	442	726	247	228	185	299	194
MIN	191	204	210	179	196	185	235	184	157	146	154	161
CFSM	1.10	1.17	1.24	1.06	1.11	1.24	1.68	1.06	.88	.83	.91	.88
IN.	1.26	1.30	1.42	1.22	1.20	1.43	1.88	1.22	.98	.96	1.05	.99

CAL YR 1987 TOTAL 76849 MEAN 211 MAX 389 MIN 145 CFSM 1.07 IN 14.44
WTR YR 1988 TOTAL 79369 MEAN 217 MAX 726 MIN 146 CFSM 1.10 IN 14.91

04128500 BURT LAKE AT INDIAN RIVER, MI

LOCATION.--Lat 45°24'38", long 84°37'12", in NE1/4 SW1/4 sec.24, T.35 N., R.3 W., Cheboygan County, Hydrologic Unit 04070004, on left bank of Indian River 500 ft downstream from Burt Lake, 2.3 mi upstream From Mullett Lake.

DRAINAGE AREA.--598 mi².

PERIOD OF RECORD.--April 1942 to current year.

GAGE.--Nonrecording gage. Datum of gage is 590.21 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Nov. 12, 1942 to Nov. 4, 1987, water-stage recorder at same datum.

REMARKS.--Burt Lake is part of the navigable inland water route. The major inlet to Burt Lake is Crooked River and the outlet is Indian River. Maple River, Sturgeon River, and Little Carp River also flow into Burt Lake. Streamflow records are currently collected for Sturgeon River (station 04128000) at a site 9 mi upstream from Burt Lake. Streamflow records for Indian River (station 04128500) were collected from April 1942 to September 1982. Lake elevation affected by regulation from dam at Cheboygan. Maximum depth 73 ft, surface area 16,700 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 5.58 ft, May 13, 14, 1960; minimum daily, 3.16 ft, Mar. 12, 1982.

EXTREMES FOR CURRENT YEAR.--Maximum gage height observed, 4.54 ft, Apr. 13; minimum observed, 3.54 ft, July 15-17.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.95	3.87	3.95	---	---	---	---	---	---	3.66	3.74	3.72
2	4.06	3.87	3.95	---	---	3.66	---	4.48	---	3.66	3.74	3.72
3	4.02	3.94	3.95	---	---	3.66	---	4.46	4.16	3.64	3.74	3.72
4	3.99	3.99	3.95	---	---	3.64	---	4.44	4.14	3.62	3.74	3.72
5	3.98	4.04	3.95	---	---	3.62	---	4.42	4.10	3.62	3.74	3.72
6	3.98	---	3.95	---	---	---	---	4.40	4.10	3.62	3.74	3.72
7	4.03	---	3.95	---	---	3.58	---	4.38	4.05	---	3.74	3.72
8	3.99	4.00	3.95	---	---	3.58	---	4.40	4.10	3.60	3.74	3.72
9	3.96	4.02	3.95	---	---	3.60	---	4.38	4.10	3.58	3.74	3.72
10	3.95	4.02	3.95	---	---	3.60	---	4.36	4.00	3.57	3.74	3.72
11	3.93	4.01	3.95	---	---	3.60	---	4.34	4.00	3.57	3.74	3.82
12	3.91	4.00	3.95	---	---	---	---	4.32	4.10	3.56	3.74	3.82
13	3.89	3.99	3.95	---	---	3.60	4.54	4.34	4.00	3.56	3.74	3.82
14	3.88	3.99	3.95	---	---	3.68	---	4.32	3.90	3.56	3.72	3.82
15	3.88	3.97	3.95	---	---	3.66	---	4.30	3.90	3.54	3.72	3.82
16	3.87	3.92	3.95	---	3.82	3.66	---	4.28	3.80	3.54	3.72	3.82
17	3.91	3.85	3.95	---	3.82	3.66	---	4.26	3.67	3.54	3.72	3.82
18	3.92	3.85	3.95	---	3.82	3.66	---	4.24	3.70	3.78	3.72	---
19	3.92	3.86	3.95	---	3.82	3.64	---	4.22	3.72	3.77	3.72	---
20	3.90	3.92	---	---	---	---	---	4.21	3.72	3.76	3.72	---
21	3.90	3.94	---	---	---	3.60	---	4.19	3.70	3.76	3.72	---
22	3.89	3.93	---	---	3.78	3.60	---	4.18	3.72	3.76	3.72	---
23	3.90	3.93	---	---	3.76	3.60	---	4.15	3.72	3.76	3.72	---
24	3.90	3.94	---	---	---	3.58	---	4.15	3.70	3.74	3.72	---
25	3.89	3.93	---	---	3.74	---	---	4.15	3.70	3.74	3.72	3.88
26	3.87	3.94	---	---	3.74	3.62	---	4.16	3.70	3.74	3.72	3.88
27	3.90	3.95	---	3.89	3.70	---	---	4.16	3.69	3.74	3.72	3.88
28	3.90	3.96	---	---	---	---	---	4.17	3.68	3.74	3.72	3.88
29	3.90	3.95	---	---	3.66	---	---	4.18	3.68	3.74	3.72	3.88
30	3.90	3.96	---	---	---	---	---	4.18	3.68	3.74	3.72	3.88
31	3.89	---	---	---	---	---	---	4.16	---	3.74	3.72	---
MEAN	3.93	---	---	---	---	---	---	---	---	---	3.73	---
MAX	4.06	---	---	---	---	---	---	---	---	---	3.74	---
MIN	3.87	---	---	---	---	---	---	---	---	---	3.72	---

04129000 PIGEON RIVER NEAR VANDERBILT, MI

LOCATION.--Lat 45°10'15", long 84°26'18", in SE1/4 SW1/4 sec.9, T.32 N., R.1 W., Otsego County, Hydrologic Unit 04070004, on right bank at Pigeon River Country State Forest Headquarters, 11.1 mi east of Vanderbilt, and 26 mi upstream from Mullett Lake.

DRAINAGE AREA.--62.6 mi².

PERIOD OF RECORD.--September 1950 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 886.24 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 31, Jan. 3, 4, 6-20, 22, 23, 25, 27-29, Feb. 4, 6, 8-23, 25, 26, 28, 29, and Mar. 1-5, 20, 22. Records good except for estimated daily discharges, which are poor. Prior to May 16, 1957, and since Apr. 22, 1958, occasional regulation by Lansing Club Dam 3.5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--38 years, 78.5 ft³/s, 17.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft³/s, May 15, 1957, gage height, 6.80 ft, from floodmark, from rating curve extended above 500 ft³/s, result of failure of Lansing Club Dam; minimum, 13 ft³/s, Jan. 8, 1957.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 380 ft³/s, Apr. 4, gage height, 4.91 ft; minimum, 29 ft³/s, June 28, but may have been less during period of ice effect; minimum gage height, 1.79 ft, Dec. 30, June 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	89	71	136	74	150	67	139	88	66	54	51	61
2	101	83	104	76	96	67	136	81	61	54	53	57
3	112	72	76	74	85	67	221	79	59	51	52	61
4	87	86	75	70	83	67	336	78	56	48	51	72
5	79	94	75	68	81	67	222	75	56	49	88	90
6	71	89	73	67	77	67	199	72	55	48	67	78
7	79	83	68	68	76	66	200	71	57	50	60	67
8	81	93	69	68	74	72	148	72	56	50	58	62
9	70	114	106	69	72	95	117	72	63	51	58	56
10	74	83	106	70	72	89	106	84	59	50	77	60
11	70	74	97	71	72	83	109	75	59	43	61	59
12	67	69	94	71	71	81	98	80	57	45	55	59
13	69	82	94	72	71	85	95	94	53	48	56	75
14	65	77	87	73	71	77	105	79	53	44	81	67
15	75	72	87	74	71	77	84	77	53	71	67	61
16	60	71	85	75	70	78	97	68	50	64	64	56
17	68	71	82	77	70	72	84	69	49	54	74	64
18	78	75	79	78	70	70	100	68	50	55	64	59
19	75	65	80	79	70	72	91	68	52	61	57	62
20	72	82	87	79	70	70	84	68	49	53	61	74
21	64	67	80	78	70	69	87	68	48	52	55	75
22	70	69	69	75	70	68	82	67	89	63	51	70
23	84	79	73	72	70	67	90	67	85	53	54	66
24	82	83	86	70	70	86	118	65	63	86	67	66
25	84	89	83	71	69	113	120	66	54	62	176	57
26	79	81	92	73	68	165	104	63	53	61	128	62
27	85	76	76	70	68	136	104	71	59	54	92	68
28	91	77	76	68	67	102	139	69	53	56	82	59
29	84	105	73	72	67	117	114	66	54	55	70	64
30	85	140	70	79	---	177	93	64	53	53	72	59
31	77	---	72	115	---	149	---	58	---	51	64	---
TOTAL	2427	2472	2610	2296	2191	2738	3822	2242	1724	1689	2166	1946
MEAN	78.3	82.4	84.2	74.1	75.6	88.3	127	72.3	57.5	54.5	69.9	64.9
MAX	112	140	136	115	150	177	336	94	89	86	176	90
MIN	60	65	68	67	67	66	82	58	48	43	51	56
CFSM	1.25	1.32	1.35	1.18	1.21	1.41	2.03	1.16	.92	.87	1.12	1.04
IN.	1.44	1.47	1.55	1.36	1.30	1.63	2.27	1.33	1.02	1.00	1.29	1.16

CAL YR 1987 TOTAL 27356 MEAN 74.9 MAX 208 MIN 47 CFSM 1.20 IN 16.26
WTR YR 1988 TOTAL 28323 MEAN 77.4 MAX 336 MIN 43 CFSM 1.24 IN 16.83

04130000 MULLETT LAKE NEAR CHEBOYGAN, MI

LOCATION.--Lat 45°34'38", long 84°29'15", in SW1/4 SW1/4 sec.19, T.37 N., R.1 W., Cheboygan County, Hydrologic Unit 04070004, on right bank of Cheboygan River, 300 ft downstream from Mullett Lake, 2.4 mi upstream from Black River, and 4.8 mi south of Cheboygan.

DRAINAGE AREA.--889 mi².

PERIOD OF RECORD.--November 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 591.21 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Mullett Lake is part of the navigable inland water route. The major inlet is Indian River. Other inlets are Pigeon, Little Pigeon, and Little Sturgeon Rivers and Negro and Scott Creeks. The outlet is Cheboygan River. Streamflow records were collected for Cheboygan River (station 04130000) from October 1942 to September 1982 and for Indian River (station 04128500) from April 1942 to September 1982. Lake level regulated by hydroelectric dam and spillway in Cheboygan. Maximum depth 147 ft, surface area 17,100 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 3.27 ft, May 13, 14, 1960; minimum daily, 0.88 ft, Mar. 19, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum daily gage height, 2.57 ft, Aug. 25; minimum daily, 1.59 ft, Mar. 24.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.37	2.22	1.90	1.94	1.94	1.75	1.92	2.49	2.25	2.37	2.42	
2	2.35	2.22	1.95	1.90	1.95	1.72	1.96	2.49	2.26	2.38	2.41	
3	2.38	2.28	1.93	1.86	1.96	1.71	2.04	2.47	2.27	2.37	2.41	
4	2.38	2.34	1.90	1.87	1.97	1.70	2.19	2.45	2.30	2.35	2.41	
5	2.36	2.33	1.89	1.89	1.97	1.68	2.27	2.43	2.31	2.35	2.45	
6	2.35	2.33	1.89	1.87	1.97	1.67	2.39	2.40	2.34	2.36	2.43	
7	2.33	2.31	1.88	1.86	1.96	1.65	2.46	2.39	2.32	2.38	2.41	
8	2.34	2.29	1.88	1.84	1.96	1.65	2.49	2.39	2.32	2.37	2.44	
9	2.36	2.27	1.92	1.84	1.95	1.66	2.48	2.37	2.31	2.36	2.43	
10	2.30	2.25	1.93	1.84	1.94	1.66	2.48	2.35	2.32	2.37	2.43	
11	2.29	2.27	1.93	1.83	1.93	1.66	2.46	2.34	2.34	2.35	2.43	
12	2.27	2.23	1.94	1.83	1.93	1.67	2.47	2.32	2.34	2.34	2.44	
13	2.27	2.19	1.95	1.85	1.92	1.71	2.46	2.36	2.34	2.35	2.46	
14	2.29	2.16	1.95	1.84	1.90	1.71	2.44	2.34	2.36	2.37	2.51	
15	2.26	2.15	1.91	1.84	1.92	1.70	2.40	2.35	2.36	2.39	2.43	
16	2.26	2.13	1.99	1.84	1.90	1.68	2.38	2.32	2.35	2.54	2.44	
17	2.27	2.15	2.00	1.83	1.89	1.68	2.37	2.31	2.37	2.52	2.52	
18	2.27	2.08	2.04	1.83	1.88	1.66	2.35	2.30	2.38	2.54	2.51	
19	2.26	2.09	2.00	1.83	1.86	1.65	2.38	2.28	2.39	2.54	2.51	
20	2.26	2.01	2.04	1.87	1.86	1.63	2.36	2.27	2.29	2.52	2.50	
21	2.24	1.98	2.06	1.89	1.85	1.67	2.34	2.26	2.25	2.49	2.48	
22	2.25	1.97	2.02	1.89	1.85	1.63	2.33	2.26	2.26	2.45	2.50	
23	2.24	1.94	2.01	1.89	1.82	1.61	2.34	2.26	2.24	2.44	2.52	
24	2.22	1.92	2.00	1.89	1.81	1.59	2.36	2.22	2.29	2.43	2.55	
25	2.22	1.90	1.99	1.89	1.80	1.62	2.38	2.22	2.30	2.42	2.57	
26	2.24	1.90	2.01	1.89	1.79	1.65	2.37	2.25	2.29	2.40	---	
27	2.24	1.89	1.97	1.90	1.77	1.69	2.39	2.25	2.34	2.40	---	
28	2.24	1.87	1.96	1.90	1.76	1.70	2.45	2.23	2.38	2.40	---	
29	2.24	1.88	1.96	1.83	1.76	1.77	2.45	2.23	2.37	2.45	---	
30	2.23	1.89	1.97	1.90	---	1.84	2.47	2.26	2.36	2.42	---	
31	2.22	---	1.95	1.93	---	1.87	---	2.26	---	2.42	---	
MEAN	2.28	2.11	1.96	1.87	1.89	1.69	2.35	2.33	2.32	2.41	---	
MAX	2.38	2.34	2.06	1.94	1.97	1.87	2.49	2.49	2.39	2.54	---	
MIN	2.22	1.87	1.88	1.83	1.76	1.59	1.92	2.22	2.24	2.34	---	

CAL YR 1987 MEAN 2.09 MAX 2.61 MIN 1.47

04130500 BLACK RIVER NEAR TOWER, MI

LOCATION.--Lat 45°23'33", long 84°20'00", in SE1/4 NE1/4 sec.29, T.35 N., R.1 E., Cheboygan County, Hydrologic Unit 04070005, on right bank 400 ft downstream from Kleber Dam, 1,000 ft upstream from Milligan Creek, 3.0 mi northwest of Tower, and 10.8 mi upstream from Black Lake.

DRAINAGE AREA.--311 mi².

PERIOD OF RECORD.--October 1942 to current year. Monthly discharge only for October 1942, published in WSP 1307.

REVISED RECORDS.--WSP 1307: 1942. WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 650.00 ft, Stanley Engineering Co. datum. Prior to Aug. 1, 1949, at site 1 mi upstream at different datum.

REMARKS.--No estimated daily discharges. Records good. Flow completely regulated by Kleber Dam 400 ft upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 272 ft³/s, 11.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,340 ft³/s, Apr. 17, 1960, gage height, 7.13 ft; minimum, 0.60 ft³/s, Mar. 11, 1950; minimum daily, 4.0 ft³/s, Nov. 27, 1949.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,250 ft³/s, Apr. 5, gage height, 5.32 ft; minimum, 5.0 ft³/s, June 24, gage height, 1.09 ft; minimum daily, 108 ft³/s, July 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	216	229	329	156	295	208	714	460	174	130	130	158
2	222	201	370	153	290	202	771	406	171	123	126	158
3	228	209	378	185	341	192	770	317	185	119	117	154
4	315	258	339	233	330	196	1100	319	180	119	117	168
5	243	279	264	212	302	194	1130	318	168	119	122	212
6	243	278	239	181	257	197	1240	270	150	118	136	240
7	238	265	216	194	181	219	1140	240	158	108	158	300
8	193	246	135	188	168	252	1000	223	168	117	180	258
9	157	246	228	186	191	258	798	269	163	117	172	211
10	234	249	313	180	216	300	725	270	163	116	148	171
11	210	280	298	170	197	294	591	312	162	116	148	144
12	199	262	299	238	185	339	496	271	160	116	147	144
13	178	247	312	220	185	278	496	318	149	116	166	167
14	146	246	349	184	185	178	460	316	144	116	175	200
15	119	222	389	163	182	270	443	267	150	116	173	192
16	189	211	307	153	181	278	398	310	134	116	181	174
17	207	210	165	200	182	248	340	269	136	120	193	167
18	179	212	195	215	183	288	342	216	127	130	193	167
19	179	196	254	177	213	250	390	195	117	152	174	161
20	183	149	329	212	228	227	386	222	122	167	146	154
21	183	149	293	254	187	191	353	235	126	145	151	154
22	182	162	326	227	201	186	324	198	127	134	148	166
23	183	218	260	190	192	229	330	207	127	134	136	185
24	183	246	234	224	195	319	315	212	161	133	136	204
25	222	204	228	242	209	375	360	217	227	133	136	197
26	251	249	339	190	213	468	453	130	180	143	161	148
27	224	232	193	189	191	517	420	227	154	166	218	149
28	243	184	187	187	193	547	459	199	138	177	248	148
29	242	226	208	173	202	548	460	198	131	161	248	148
30	241	207	182	211	---	630	460	196	130	150	178	149
31	241	---	180	237	---	644	---	191	---	142	147	---
TOTAL	6473	6859	8418	6124	6275	9522	17672	7998	4582	4069	5009	5348
MEAN	209	229	272	198	216	307	589	258	153	131	162	178
MAX	315	287	389	254	341	644	1240	460	227	177	248	300
MIN	119	149	135	153	168	178	315	130	117	108	117	144
CFSM	.67	.74	.88	.64	.70	.99	1.89	.83	.49	.42	.52	.57
IN.	.77	.82	1.01	.73	.75	1.14	2.11	.96	.55	.49	.60	.64

CAL YR 1987 TOTAL 78910 MEAN 216 MAX 490 MIN 111 CFSM .70 IN 9.44
WTR YR 1988 TOTAL 88349 MEAN 241 MAX 1240 MIN 108 CFSM .78 IN 10.57

04132052 CHEBOYGAN POND AT CHEBOYGAN, MI

LOCATION.--Lat 45°38'09", long 84°28'50", in SW1/4 SE1/4 sec.31, T.38 N., R.1 W., Cheboygan County, Hydrologic Unit 04070004, on right bank 660 ft downstream from Lincoln Avenue in Cheboygan, 1.8 mi upstream from mouth of Cheboygan River.

DRAINAGE AREA.--1,500 mi², approximately.

PERIOD OF RECORD.--November 1942 to current year

GAGE.--Water-stage recorder. Datum of gage is 590.00 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 30, 1967, nonrecording gage at same datum.

REMARKS.--Cheboygan Pond is formed by an earthfill dam, hydro-electric dam, boat lock and concrete spillway which contains 6 vertical lift gates. Cheboygan Pond is part of the navigable inland water route. The inlet and outlet of Cheboygan Pond is the Cheboygan River. Other inlets are Black River and Tannery Gulley. Streamflow records for Cheboygan River (station 04130000) were collected from October 1942 to September 1982. Pond elevation regulated by hydroelectric dam and spillway.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.83 ft, Oct. 19, 1984; minimum, -0.27 ft, Mar. 11, 12, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.69 ft, Sept. 13, 14; minimum, 1.89 ft, Mar. 21.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.11	2.98	2.35	2.36	2.49	2.27	2.23	2.81	2.97	3.33	3.29	3.39
2	3.12	2.94	2.54	2.35	2.49	2.24	2.25	2.82	3.01	3.33	3.29	3.36
3	3.11	3.00	2.38	2.37	2.49	2.24	2.32	2.75	3.07	3.30	3.28	3.36
4	3.08	2.99	2.35	2.34	2.49	2.22	2.35	2.74	3.17	3.23	3.30	3.36
5	3.10	2.95	2.38	2.33	2.49	2.23	2.23	2.72	3.18	3.28	3.31	3.42
6	3.12	2.90	2.36	2.34	2.49	2.21	2.31	2.70	3.24	3.26	3.25	3.43
7	3.09	2.90	2.36	2.34	2.49	2.21	2.38	2.77	3.19	3.31	3.31	3.39
8	3.09	2.91	2.36	2.34	2.48	2.18	2.29	2.74	3.16	3.30	3.34	3.41
9	3.09	2.97	2.38	2.33	2.47	2.18	2.17	2.73	3.19	3.31	3.28	3.41
10	3.05	2.84	2.38	2.34	2.44	2.18	2.15	2.74	3.09	3.28	3.28	3.42
11	3.05	2.65	2.37	2.34	2.43	2.16	2.20	2.69	3.23	3.26	3.30	3.44
12	3.05	2.80	2.38	2.35	2.43	2.15	2.28	2.69	3.26	3.29	3.38	3.54
13	3.04	2.69	2.36	2.36	2.45	2.15	2.33	2.71	3.26	3.31	3.43	3.61
14	3.10	2.68	2.38	2.37	2.43	2.16	2.27	2.71	3.28	3.32	3.36	3.50
15	3.04	2.68	2.33	2.37	2.44	2.13	2.13	2.74	3.28	3.36	3.39	3.39
16	3.03	2.65	2.34	2.38	2.42	2.11	2.12	2.72	3.29	3.32	3.43	3.39
17	2.97	2.61	2.36	2.36	2.40	2.12	2.12	2.74	3.30	3.30	3.32	3.38
18	2.97	2.60	2.44	2.38	2.39	2.09	2.37	2.73	3.27	3.42	3.39	3.36
19	2.97	2.57	2.39	2.39	2.39	2.07	2.55	2.75	3.23	3.29	3.40	3.39
20	2.98	2.51	2.48	2.43	2.39	2.05	2.44	2.77	3.02	3.30	3.39	3.40
21	2.98	2.37	2.46	2.42	2.40	2.34	2.42	2.79	2.95	3.26	3.39	3.39
22	2.98	2.39	2.38	2.43	2.40	2.06	2.49	2.80	2.96	3.26	3.50	3.39
23	2.97	2.37	2.38	2.41	2.36	2.04	2.56	2.84	3.09	3.28	3.50	3.38
24	2.94	2.36	2.41	2.41	2.34	2.02	2.54	2.82	3.27	3.26	3.42	3.36
25	2.96	2.35	2.39	2.41	2.35	2.09	2.67	2.83	3.24	3.28	3.39	3.36
26	2.98	2.36	2.39	2.43	2.31	2.06	2.59	2.90	3.25	3.28	3.39	3.38
27	3.01	2.36	2.36	2.49	2.30	2.06	2.63	2.96	3.35	3.23	3.40	3.36
28	3.00	2.37	2.37	2.47	2.29	2.07	2.66	2.93	3.35	3.30	3.39	3.35
29	2.97	2.36	2.33	2.47	2.30	2.12	2.69	2.95	3.31	3.40	3.40	3.36
30	2.96	2.36	2.36	2.49	---	2.15	2.72	3.01	3.31	3.29	3.40	3.37
31	2.95	---	2.38	2.51	---	2.18	---	3.02	---	3.30	3.39	---
MEAN	3.03	2.65	2.38	2.39	2.42	2.15	2.38	2.79	3.19	3.30	3.36	3.40
MAX	3.12	3.00	2.54	2.51	2.49	2.34	2.72	3.02	3.35	3.42	3.50	3.61
MIN	2.94	2.35	2.33	2.33	2.29	2.02	2.12	2.69	2.95	3.23	3.25	3.35

CAL YR 1987 MEAN 2.77 MAX 3.45 MIN 1.88
WTR YR 1988 MEAN 2.79 MAX 3.61 MIN 2.02

04135000 THUNDER BAY RIVER NEAR ALPENA, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°05'39", long 83°29'59", in SW1/4 SE1/4 sec.7, T.31 N., R.8 E., Alpena County, Hydrologic Unit 04070006, on left bank 1,000 ft downstream from Alpena Power Company Fourmile Dam, 2.5 mi upstream from Bagley Street in Alpena, and 6.0 mi upstream from mouth.

DRAINAGE AREA.--1,238 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1901 to December 1908, October 1979 to current year. Occasional discharge measurements, water years 1945-50.

REVISED RECORDS.--WSP 1307: 1901-09. WDR MI-80: Drainage area.

GAGE.--Two water-stage recorders. Elevation of gage on main (north) channel and secondary gage on (south) channel is 615 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 3 to Mar. 28, and Aug. 24 to Sept. 30. Water-discharge records good except for estimated daily discharges, which are poor. Flow regulated at all stages by hydroelectric plant 1,000 ft upstream.

AVERAGE DISCHARGE.--16 years (water years 1902-08, 1980-88), 913 ft³/s, 10.01 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 12,100 ft³/s, Mar. 28, 1986; minimum daily, 30 ft³/s, June 5, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 6,520 ft³/s, Apr. 1; minimum daily, 30 ft³/s, June 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	789	646	1140	654	1590	849	6520	1760	510	611	556	467
2	863	669	1160	654	1780	844	5900	1430	626	40	430	678
3	652	631	1200	838	1800	824	5250	1400	771	46	451	207
4	648	651	1170	957	1530	878	5380	1260	299	57	382	43
5	752	714	1110	952	1240	540	5660	1260	30	330	492	411
6	675	715	880	798	1240	536	5580	1230	628	309	78	627
7	671	678	834	810	1070	931	4790	328	508	538	121	446
8	659	869	1200	765	899	1080	3990	295	497	394	593	627
9	653	844	1200	653	1020	1110	3240	782	489	64	512	526
10	571	769	846	647	1020	1210	2500	992	469	359	504	33
11	540	845	804	779	925	1210	1970	836	271	426	466	137
12	498	725	1130	928	836	1100	1660	885	239	374	392	488
13	470	821	1180	916	532	966	1650	923	538	371	294	428
14	531	761	1140	919	679	1000	1640	412	505	364	474	464
15	546	748	1100	874	993	1040	1460	836	526	510	530	484
16	493	717	1210	514	911	1150	972	1000	488	134	914	485
17	583	703	1200	706	869	1040	1030	926	407	339	679	33
18	516	690	1080	1080	923	978	1160	631	49	580	411	118
19	597	673	1010	1010	902	724	1180	671	107	480	394	556
20	549	646	1150	1070	561	926	1060	778	331	432	32	475
21	541	543	1210	1090	697	991	926	500	216	446	419	403
22	528	447	1210	1070	932	867	839	455	318	428	587	474
23	537	419	1210	742	879	890	617	662	448	76	565	544
24	633	442	1210	966	874	1030	941	713	514	80	390	31
25	683	541	1220	1030	761	1400	1190	718	540	384	339	116
26	699	629	1230	966	849	2150	1210	517	197	419	665	424
27	802	722	1230	971	759	3440	1220	600	218	455	449	327
28	737	803	1200	785	651	3440	1520	412	487	484	259	335
29	707	838	1080	873	976	3470	1710	360	370	408	607	399
30	674	1080	1020	809	---	4150	1780	412	353	79	427	547
31	604	---	788	985	---	5410	---	634	---	107	689	---
TOTAL	19401	20979	34352	26811	28698	46174	74545	24618	11949	10124	14101	11333
MEAN	626	699	1108	865	990	1489	2485	794	398	327	455	378
MAX	863	1080	1230	1090	1800	5410	6520	1760	771	611	914	678
MIN	470	419	788	514	532	536	617	295	30	40	32	31
CFSM	.51	.57	.90	.70	.80	1.20	2.01	.64	.32	.26	.37	.31
IN.	.58	.63	1.03	.81	.86	1.39	2.24	.74	.36	.30	.42	.34

CAL YR 1987 TOTAL 249220 MEAN 683 MAX 2130 MIN 31 CFSM .55 IN 7.49
WTR YR 1988 TOTAL 323085 MEAN 883 MAX 6520 MIN 30 CFSM .71 IN 9.71

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--October 1979 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1979 to September 1985.
WATER TEMPERATURE: October 1979 to September 1985.

INSTRUMENTATION.--Water-quality monitor from Oct. 9, 1980 to Sept. 30, 1985.

REMARKS.--Bimonthly cross-sectional samples were collected near the gage; the April sample was collected at Bagley Street bridge, 2.5 mi downstream from gage. From February 1979 to September 1979, samples were collected 6.9 mi downstream from gage (station 04135020).

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1980-83): Maximum, 511 microsiemens, Jan. 2, 1982; minimum measured, 120 microsiemens, Dec. 19, 1981.
WATER TEMPERATURE (water years 1980-83): Maximum, 31.0°C, July 11, 12, 1981; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV 03...	1000	482	398	8.27	7.0	0.90	11.8	99	K2	K8
DEC 03...	1100	1220	415	8.05	2.5	1.4	13.1	99	K9	37
FEB 04...	1330	1530	336	7.74	0.5	1.9	14.0	99	K42	830
APR 05...	1430	5470	246	7.82	3.0	3.7	13.1	100	E160	69
JUL 21...	1400	1240	357	8.39	25.0	1.1	8.3	103	K12	K2
AUG 24...	1330	830	304	8.26	21.5	0.60	8.2	96	K3	K14

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV 03...	210	19	56	16	5.3	5	0.2	1.1	228	0
DEC 03...	210	21	58	15	6.1	6	0.2	1.1	227	0
FEB 04...	160	17	45	11	4.1	5	0.1	1.8	173	0
APR 05...	120	--	36	8.1	2.6	4	0.1	1.4	--	--
JUL 21...	160	7	38	15	5.1	7	0.2	0.40	176	4
AUG 24...	180	26	45	16	5.0	6	0.2	0.50	185	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV 03...	187	14	6.1	0.20	9.2	224	0.30	292	<0.010	<0.100
DEC 03...	186	16	9.3	0.30	9.6	230	0.31	760	<0.010	<0.100
FEB 04...	141	15	6.0	0.20	7.3	183	0.25	756	0.020	0.310
APR 05...	--	17	4.9	0.10	5.1	150	0.20	2220	<0.010	0.130
JUL 21...	150	12	13	0.20	9.2	200	0.27	670	<0.010	<0.100
AUG 24...	152	14	4.5	0.20	9.7	198	0.27	444	<0.010	<0.100

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV 03...	0.020	0.020	0.60	<0.010	<0.010	<0.010	<10	<1	19	<0.5
DEC 03...	0.020	0.020	0.90	0.020	0.010	<0.010	<10	<1	20	<0.5
FEB 04...	0.050	0.040	0.40	0.030	0.010	<0.010	--	--	--	--
APR 05...	0.030	0.020	0.60	0.030	0.020	<0.010	<10	<1	19	<0.5
JUL 21...	0.050	0.010	0.40	0.020	0.020	<0.010	--	--	--	--
AUG 24...	0.050	--	0.70	0.020	0.020	0.020	<10	<1	19	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV 03...	<1	<1	<3	3	27	<5	5	2	<0.1	<10
DEC 03...	<1	<1	<3	2	31	<5	4	5	0.5	<10
FEB 04...	--	--	--	--	--	--	--	--	--	--
APR 05...	<1	<1	<3	2	60	<5	16	10	<0.1	<10
JUL 21...	--	--	--	--	--	--	--	--	--	--
AUG 24...	<1	<1	<3	2	19	<5	5	3	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 03...	<1	<1	<1.0	110	<6	4	4	5.2	72
DEC 03...	4	<1	<1.0	110	<6	18	4	13	72
FEB 04...	--	--	--	--	--	--	7	29	94
APR 05...	2	<1	<1.0	70	<6	<3	24	354	64
JUL 21...	--	--	--	--	--	--	4	13	80
AUG 24...	<1	<1	<1.0	95	<6	25	4	9.0	52

04135500 AU SABLE RIVER AT GRAYLING, MI

LOCATION.--Lat 44°39'35", long 84°42'45", in SE1/4 SE1/4 sec. 7, T.26 N., R.3 W., Crawford County, Hydrologic Unit 04070007, on right bank 65 ft upstream from bridge on Interstate Highway 75 (Business Loop) in Grayling, 0.7 mi upstream from East Branch, and 114 mi upstream from mouth.

DRAINAGE AREA.--110 mi^2.

PERIOD OF RECORD.--October 1942 to current year. Monthly discharge only for some periods, published in WSP 1307. Prior to October 1954, published as Middle Branch Au Sable River at Grayling.

GAGE.--Water-stage recorder and steel-crested dam. Datum of gage is 1,123.49 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Jan. 1-15, 24-26 and Feb. 4 to 13. Records good except for estimated daily discharges, which are poor. Prior to Dec. 31, 1952, diurnal fluctuation caused by powerplant 2.5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 75.8 ft^3/s, 9.36 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 274 ft^3/s, June 2, 1943, gage height, 3.00 ft; minimum, 28 ft^3/s, Apr. 21, 1946, gage height, 0.80 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 195 ft^3/s, Apr. 5, gage height, 2.41 ft; minimum discharge, 54 ft^3/s, July 7-10; minimum gage height, 1.17 ft, July 9, 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	81	81	129	75	128	72	139	101	71	60	62	68
2	84	79	121	75	124	78	135	96	70	60	60	65
3	90	82	106	75	100	78	157	93	70	60	58	64
4	90	86	98	72	90	71	184	91	69	59	58	65
5	85	90	94	70	82	73	191	88	68	58	65	67
6	81	91	90	68	78	79	178	87	68	56	79	66
7	81	89	89	70	78	79	171	86	67	55	86	64
8	81	92	90	72	78	80	159	85	67	54	76	62
9	79	100	99	72	78	88	142	86	69	54	69	62
10	75	101	115	72	78	93	129	91	68	56	67	61
11	74	94	118	72	78	90	122	93	68	62	65	61
12	73	88	113	72	78	89	117	91	67	63	63	61
13	71	87	108	72	78	89	112	91	66	63	61	62
14	70	88	102	72	80	85	109	91	64	70	61	62
15	70	87	100	74	81	83	107	90	63	70	60	61
16	70	86	95	79	81	82	105	86	62	69	66	60
17	71	83	99	83	83	80	104	84	62	65	72	61
18	73	80	98	90	83	79	104	82	62	62	76	62
19	73	80	95	94	83	78	102	80	62	61	72	62
20	73	80	96	94	84	76	100	80	62	58	67	68
21	72	77	95	90	76	73	97	78	63	61	63	71
22	72	79	94	78	80	77	96	78	73	65	60	70
23	74	80	92	76	84	78	99	79	76	67	60	70
24	80	84	92	74	78	83	106	76	71	69	63	68
25	85	91	93	73	78	96	111	73	67	64	69	67
26	84	92	95	72	78	117	108	74	63	62	81	64
27	86	89	90	71	80	123	107	76	62	61	84	62
28	90	87	92	77	78	114	110	76	61	61	81	60
29	91	94	90	80	78	112	112	76	61	61	76	59
30	87	117	75	82	---	134	109	73	60	61	71	60
31	84	---	75	100	---	144	---	72	---	63	70	---
TOTAL	2450	2634	3038	2396	2433	2773	3722	2603	1982	1910	2121	1915
MEAN	79.0	87.8	98.0	77.3	83.9	89.5	124	84.0	66.1	61.6	68.4	63.8
MAX	91	117	129	100	128	144	191	101	76	70	86	71
MIN	70	77	75	68	76	71	96	72	60	54	58	59
CFSM	.72	.80	.89	.70	.76	.81	1.13	.76	.60	.56	.62	.58
IN.	.83	.89	1.03	.81	.82	.94	1.26	.88	.67	.65	.72	.65

CAL YR 1987 TOTAL 31026 MEAN 85.0 MAX 181 MIN 56 CFSM .77 IN 10.49
WTR YR 1988 TOTAL 29977 MEAN 81.9 MAX 191 MIN 54 CFSM .75 IN 10.14

04135700 SOUTH BRANCH AU SABLE RIVER NEAR LUZERNE, MI

LOCATION.--Lat 44°36'53", long 84°27'20", in SE1/4 SE1/4 sec.29, T.26 N., R.1 W., Crawford County, Hydrologic Unit 04070007, on right bank 10 ft upstream from Smith Bridge, 400 ft downstream from bridge on State Highway 72, 4.6 mi upstream from mouth, and 9.1 mi west of Luzerne.

DRAINAGE AREA.--401 mi^2.

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1951-66. October 1966 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,070 ft above National Geodetic Vertical Datum of 1929, from topographic map. Apr. 19, 1951, to Nov. 14, 1966, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 15, 27, and Feb. 2-15. Records good except for estimated daily discharges, which are fair. Occasional regulation by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 224 ft^3/s, 7.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,120 ft^3/s, Mar. 28, 1976, gage height, 7.30 ft; maximum gage height, 7.75 ft, Jan. 28, 1986, backwater from ice; minimum discharge, 78 ft^3/s, Feb. 12, 1981, gage height, 3.98 ft, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 690 ft^3/s, Apr. 5, gage height, 6.18 ft; maximum gage height, 6.37 ft, Jan. 7, backwater from ice; minimum discharge, 109 ft^3/s, Aug. 22, 23; minimum gage height, 4.19 ft, July 8-10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	196	215	288	190	297	165	584	342	147	120	120	124
2	202	213	284	180	250	165	604	326	145	119	115	121
3	203	217	276	175	230	160	610	314	142	118	113	126
4	202	218	263	170	210	163	653	305	140	117	116	145
5	195	224	248	165	200	160	681	299	138	115	121	151
6	191	228	227	160	190	162	671	288	137	115	130	150
7	191	227	211	160	185	163	640	277	135	114	145	142
8	189	236	215	160	180	172	601	270	135	114	127	133
9	184	239	247	160	180	203	564	268	140	113	128	127
10	178	235	268	160	180	204	520	276	139	115	134	122
11	174	230	270	160	180	219	484	273	135	119	135	119
12	171	223	276	160	180	228	457	266	132	123	123	117
13	167	217	277	160	180	220	437	262	130	118	118	129
14	166	212	266	160	180	206	421	239	128	139	119	140
15	163	207	255	165	180	197	402	211	126	147	115	135
16	163	202	211	170	181	198	391	195	125	138	118	127
17	165	200	207	167	179	188	383	184	126	128	127	125
18	166	202	214	182	176	206	373	175	124	126	124	126
19	167	202	224	185	179	192	361	169	123	124	118	129
20	172	202	237	189	178	180	353	165	123	121	114	161
21	175	190	237	189	172	175	344	164	121	122	112	166
22	180	188	240	189	170	185	332	165	134	123	110	165
23	188	194	240	187	166	187	335	168	143	121	112	163
24	200	200	240	180	170	214	352	159	138	120	121	156
25	209	205	243	177	175	282	354	153	129	122	135	149
26	207	206	239	175	170	382	354	151	124	134	151	141
27	216	204	223	176	168	390	349	154	123	123	146	134
28	224	205	230	178	168	371	363	160	122	128	137	131
29	223	226	223	171	166	367	358	156	122	125	128	127
30	218	276	210	172	---	450	349	152	121	122	124	124
31	215	---	200	233	---	506	---	150	---	124	124	---
TOTAL	5860	6445	7489	5405	5420	7260	13680	6836	3947	3807	3860	4105
MEAN	189	215	242	174	187	234	456	221	132	123	125	137
MAX	224	276	288	233	297	506	681	342	147	147	151	166
MIN	163	188	200	160	166	160	332	150	121	113	110	117
CFSM	.47	.54	.60	.43	.47	.58	1.14	.55	.33	.31	.31	.34
IN.	.54	.60	.69	.50	.50	.67	1.27	.63	.37	.35	.36	.38

CAL YR 1987 TOTAL 65370 MEAN 179 MAX 302 MIN 116 CFSM .45 IN 6.06
WTR YR 1988 TOTAL 74114 MEAN 202 MAX 681 MIN 110 CFSM .50 IN 6.88

445512084415301 OTSEGO LAKE NEAR GAYLORD, MI

LOCATION.--Lat 44°55'52", long 84°41'33", in SW1/4 SE1/4 sec.5, T.29 N., R.3 W., Otsego County, Hydrologic Unit 04070007, at Otsego Lake State Park, 200 ft northwest of boat ramp, 6.7 mi south of Gaylord.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--August 1942 to current year, except for winter months 1942-43, 1943-44, 1977-78.

GAGE.--Water-stage recorder. Datum of gage is 1,270.03 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 18, 1958, nonrecording gage at datum 2.0 ft higher.

REMARKS.--Otsego Lake has no natural inlets or outlets. In December 1972 an outlet tube and pump system was installed connecting the lake with the North Branch Au Sable River to lower lake levels. Maximum depth 23 ft, surface area 1,970 acres. Established legal level; maximum, 1,273.5 ft, minimum, 1,272.0 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 5.10 ft, May 6, 7, 1972; minimum, 0.96 ft, Aug. 14, 1959.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.79 ft, Apr. 4, 7-9; minimum, 2.19 ft, Sept. 19.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.65	2.73	3.00	3.20	3.49	3.44	3.67	3.50	3.18	2.66	2.37	2.35
2	2.74	2.72	2.93	3.20	3.40	3.44	3.67	3.47	3.15	2.63	2.36	2.34
3	2.74	2.74	2.91	3.20	3.38	3.44	3.72	3.46	3.13	2.62	2.35	2.36
4	2.69	2.77	2.90	3.20	3.37	3.44	3.78	3.45	3.11	2.61	2.34	2.40
5	2.68	2.81	2.90	3.22	3.37	3.43	3.77	3.44	3.09	2.60	2.34	2.39
6	2.69	2.81	2.90	3.24	3.37	3.42	3.77	3.43	3.08	2.58	2.35	2.36
7	2.70	2.81	2.90	3.24	3.38	3.42	3.79	3.42	3.06	2.57	2.32	2.33
8	2.69	2.83	2.91	3.24	3.39	3.43	3.79	3.39	3.06	2.55	2.30	2.31
9	2.67	2.84	2.96	3.24	3.39	3.56	3.78	---	3.05	2.53	2.31	2.31
10	2.66	2.84	3.01	3.24	3.39	3.51	3.77	---	3.01	2.52	2.30	2.30
11	2.65	2.82	3.02	3.24	3.39	3.49	3.76	---	2.97	2.53	2.29	2.29
12	2.64	2.81	3.03	3.25	3.39	3.49	3.75	3.36	2.96	2.51	2.28	2.28
13	2.63	2.81	3.05	3.25	3.39	3.52	3.73	3.38	2.93	2.47	2.26	2.30
14	2.64	2.81	3.06	3.25	3.40	3.52	3.72	3.36	2.91	2.52	2.38	2.29
15	2.65	2.80	3.08	3.25	3.41	3.52	3.70	3.34	2.89	2.50	2.31	2.26
16	2.64	2.00	3.15	3.25	3.42	3.51	3.68	3.36	2.88	2.52	2.28	2.24
17	2.66	2.77	3.14	3.26	3.42	3.50	3.65	3.35	2.86	2.52	2.31	2.24
18	2.67	2.82	3.14	3.28	3.42	3.50	3.66	3.32	2.83	2.50	2.30	2.24
19	2.68	2.81	3.14	3.29	3.43	3.50	3.63	3.31	2.80	2.50	2.29	2.23
20	2.66	2.85	3.17	3.30	3.44	3.51	3.61	3.31	2.80	2.48	2.28	2.29
21	2.66	2.84	3.18	3.32	3.43	3.49	3.59	3.31	2.77	2.49	2.26	2.30
22	2.66	2.82	3.18	3.32	3.43	3.49	3.56	3.30	2.84	2.50	2.24	2.28
23	2.68	2.82	3.18	3.32	3.43	3.50	3.55	3.30	2.83	2.49	---	2.30
24	2.69	2.84	3.18	3.32	3.43	3.54	3.57	3.29	2.79	2.48	2.33	2.29
25	2.70	2.86	3.21	3.32	3.44	3.58	3.56	3.25	2.80	2.46	2.37	2.28
26	2.68	2.87	3.21	3.33	3.44	3.63	3.54	3.22	2.78	2 46	2.41	2.26
27	2.72	2.85	3.21	3.32	3.44	3.57	3.53	3.22	2.73	2.43	2.39	2.28
28	2.74	2.85	3.21	3.32	3.44	3.57	3.55	3.21	2.72	2.43	2.40	2.26
29	2.74	2.87	3.21	3.32	3.44	3.58	3.54	3.21	2.70	2.41	2.39	2.23
30	2.74	2.96	3.20	3.32	---	3.67	3.52	3.20	2.68	2.42	2.38	2.23
31	2.74	---	3.20	3.51	---	3.68	- -	3.19	---	2.40	2.37	---
MEAN	2.68	2.82	3.08	3.28	3.41	3.51	3.66	---	2.91	2.51	---	2.29
MAX	2.74	2.96	3.21	3.51	3.49	3.68	3.79	---	3.18	2.66	---	2.40
MIN	2.63	2.72	2.90	3.20	3.37	3.42	3.52	---	2.68	2.40	---	2.23

04136500 AU SABLE RIVER AT MIO, MI

LOCATION.--Lat 44°39'36", long 84°07'52", in SE1/4 NE1/4 sec.12, T.26 N., R.2 E., Oscoda County, Hydrologic Unit 04070007, on right bank 150 ft upstream from bridge on State Highway 33 in Mio, 500 ft downstream from Mio hydroelectric plant, 9.5 mi downstream from Big Creek, and 73.0 mi upstream from mouth.

DRAINAGE AREA.--1,100 mi², approximately.

PERIOD OF RECORD.--July 1952 to current year.

GAGE.--Water-stage recorder. Datum of gage is 929.60 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Mio Dam 500 ft upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--36 years, 997 ft³/s, 12.31 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,380 ft³/s, Sept. 30, 1986, gage height, 6.16 ft; minimum, 7.0 ft³/s, Aug. 4, 1977, gage height, -0.09 ft; minimum daily, 21 ft³/s, Aug. 9, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,610 ft³/s, Mar. 30, gage height, 4.94 ft; minimum, 228 ft³/s, May 17, gage height, 1.42 ft; minimum daily, 591 ft³/s, Jan. 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	968	944	1290	1030	1510	825	1880	1330	850	721	737	759
2	968	943	1200	802	1300	808	1880	1210	818	704	723	764
3	993	945	1120	889	979	829	2090	1170	801	695	705	737
4	993	1010	1130	1010	1050	791	2350	1140	800	708	715	784
5	959	1030	1040	738	1030	825	2300	1110	799	720	808	853
6	916	1030	993	591	830	865	2170	1080	801	713	928	869
7	925	1000	930	626	701	845	2240	1070	804	681	888	840
8	879	991	951	747	930	841	2100	1060	797	680	834	783
9	904	1060	1070	879	919	1030	1830	1020	797	682	842	759
10	878	1060	1190	843	912	1000	1620	1100	800	685	851	724
11	851	1030	1140	850	889	967	1560	1090	799	775	793	705
12	851	997	1230	944	918	1020	1500	1140	772	756	776	733
13	851	980	1170	885	919	1020	1440	1140	759	725	742	723
14	847	969	1090	816	860	966	1440	1090	759	751	720	721
15	829	917	1100	836	914	912	1380	1030	762	784	757	741
16	822	924	1080	875	924	902	1310	1000	746	782	754	737
17	839	942	963	963	893	912	1290	929	734	782	753	771
18	845	946	996	1020	955	875	1260	949	732	751	763	768
19	847	929	1010	996	929	895	1240	930	732	764	765	752
20	894	916	1060	1000	885	897	1230	904	732	766	752	800
21	853	907	1050	1010	826	869	1230	900	732	699	728	842
22	871	884	1020	837	846	868	1150	937	732	746	701	857
23	923	875	1020	889	904	912	1240	922	792	776	715	871
24	978	916	1020	996	868	1050	1290	877	856	754	745	846
25	1030	980	1020	882	835	1140	1430	852	829	748	803	789
26	986	987	1070	816	881	1620	1340	832	762	827	908	780
27	1000	955	1020	784	895	1590	1300	865	737	837	899	778
28	1010	942	974	820	845	1380	1310	872	700	781	865	781
29	1030	1010	990	893	846	1330	1410	856	695	744	840	763
30	992	1230	797	988	---	2060	1360	851	717	750	796	716
31	952	---	914	1240	---	2070	---	851	---	750	770	---
TOTAL	28484	29249	32648	27495	26993	32914	47170	31107	23146	23037	24381	23346
MEAN	919	975	1053	887	931	1062	1572	1003	772	743	786	778
MAX	1030	1230	1290	1240	1510	2070	2350	1330	856	837	928	871
MIN	822	875	797	591	701	791	1150	832	695	680	701	705
CFSM	.84	.89	.96	.81	.85	.97	1.43	.91	.70	.68	.72	.71
IN.	.96	.99	1.10	.93	.91	1.11	1.60	1.05	.78	.78	.82	.79

CAL YR 1987 TOTAL 344156 MEAN 943 MAX 1970 MIN 682 CFSM .86 IN 11.64
WTR YR 1988 TOTAL 349970 MEAN 956 MAX 2350 MIN 591 CFSM .87 IN 11.84

04137500 AU SABLE RIVER NEAR AU SABLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°26'09", long 83°26'28", in NE1/4 NW1/4 sec.35, T.24 N., R.8 E., Iosco County, Hydrologic Unit 04070007, at bridge on Rea Road, 5.5 mi northwest of Au Sable, and 10.4 mi upstream from mouth.

DRAINAGE AREA.--1,540 mi², approximately.

WATER DISCHARGE RECORDS

PERIOD OF RECORD.--August 1987 to September 1988. Records for July 1939 to September 1940, published in WSP 874, 894, and 1307, have been found to be unreliable and should not be used.

GAGE.--Water-stage recorder. Datum of gage is 583.93 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Aug. 1-7, Aug. 13 to Sept. 1, Oct. 1 to Dec. 31, 1987, and Jan. 14-17, 1988. Water-discharge records good except for estimated daily discharges, which are poor. Flow regulated by Foote Dam 0.6 mi upstream.

EXTREMES FOR CURRENT PERIOD.--August 1987 to September 1988: Maximum discharge, 3,580 ft³/s, Sept. 4, 1987, gage height, 13.14 ft; minimum, 443 ft³/s, Aug. 13, 1987, gage height, 7.52; minimum daily, 460 ft³/s, Aug. 13, 1987.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1											700	1200
2											760	1170
3											2540	994
4											2500	1220
5											1200	1120
6											1200	1330
7											1020	980
8											1220	1600
9											2050	738
10											3530	1900
11											2890	621
12											1850	1050
13											460	1300
14											470	1130
15											480	1130
16											2200	1150
17											3300	1320
18											2500	2060
19											2000	751
20											1550	2300
21											1900	2580
22											1600	1800
23											1150	1880
24											1400	1130
25											1150	966
26											540	1260
27											1600	1410
28											1120	1300
29											1200	1380
30											1200	1340
31											1250	---
TOTAL											48530	40110
MEAN											1565	1337
MAX											3530	2580
MIN											460	621
CFSM											1.02	.87
IN.											1.17	.97

04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988 MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1300	1520	2000	1600	3010	1160	2520	2090	3260	862	1080	579
2	1530	1190	1850	893	757	1200	2430	1780	2100	905	1120	577
3	1500	1430	1650	1550	1570	1040	2770	1600	1170	993	1120	768
4	1450	1900	1450	1500	1570	1330	3040	1780	1400	996	1090	1070
5	1300	1500	1250	836	1330	990	3050	1360	1260	999	1130	1900
6	1150	1300	1800	837	1080	1360	3420	1610	1260	959	1230	2380
7	1250	1100	1050	867	852	1250	3180	1640	829	1010	1210	1660
8	1200	1500	1850	1330	1410	1380	3320	1450	571	985	1440	1070
9	1250	1850	1310	1900	1420	1560	2590	1400	573	1070	1430	1090
10	1050	1750	1870	2050	1210	1610	2510	1680	577	1060	1290	1150
11	1150	1150	1700	1270	935	1670	1380	1940	578	1100	1260	1140
12	1300	1300	1900	1690	1320	1510	2130	1290	577	1180	1370	1170
13	1200	1450	1850	1280	1490	1780	1980	1690	884	1150	1260	1100
14	1100	1500	1450	1100	1170	1320	1730	1830	1000	1210	1890	1020
15	1050	1300	1800	1000	1460	1290	2060	1410	989	1080	2210	1080
16	1250	1250	2000	1500	1280	1300	1950	1460	977	1100	1380	1040
17	1100	1420	1250	1600	1540	1170	1780	1360	932	1250	1090	1100
18	1250	1320	1850	1600	1240	1350	1840	1500	1060	1220	1270	1130
19	1050	1400	1000	1650	1420	1150	1750	1250	1140	1130	1040	982
20	1200	1200	1850	1550	1390	1630	1830	1260	1080	1070	946	1080
21	1350	1300	2000	1290	1010	1580	1740	1300	1030	948	1150	1730
22	1150	1100	1300	920	1350	1710	1660	1500	1030	1060	1140	1350
23	1650	1300	1600	1830	1530	2010	1620	1270	1120	1150	1050	1010
24	1500	1400	1100	1220	1220	1440	1770	1260	1200	1130	1100	871
25	1570	1550	2000	1370	1170	2150	1800	1260	1210	1120	1610	930
26	1300	1800	1600	1250	1280	2180	1850	1180	1110	1840	1090	970
27	1930	1400	1500	1060	1370	2740	1900	1110	1260	1080	1060	869
28	1050	1200	1350	1380	1090	1920	2020	1110	1190	981	1520	810
29	1500	1600	1450	1140	1370	2110	2030	1110	819	841	857	790
30	1400	1900	1020	1530	---	2480	2130	1210	923	1260	576	785
31	1210	---	1300	2310	---	3440	---	2020	---	1020	576	---
TOTAL	40240	42880	48950	42903	38844	50810	65780	45710	33109	33759	37585	33201
MEAN	1298	1429	1579	1384	1339	1639	2193	1475	1104	1089	1212	1107
MAX	1930	1900	2000	2310	3010	3440	3420	2090	3260	1840	2210	2380
MIN	1050	1100	1000	836	757	990	1380	1110	571	841	576	577
CFSM	.84	.93	1.03	.90	.87	1.06	1.42	.96	.72	.71	.79	.72
IN.	.97	1.04	1.18	1.04	.94	1.23	1.59	1.10	.80	.82	.91	.80

WTR YR 1988 TOTAL 513771 MEAN 1404 MAX 3440 MIN 571 CFSM .91 IN 12.41

04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Bimonthly cross-sectional samples were colleccted at bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1978-79): Maximum daily, 346 microsiemens, Nov. 21, 1978; minimum daily, 229 microsiemens, Apr. 19, 21, 1979.
WATER TEMPERATURE (water years 1979-80): Maximum measured, 26.0°C, Aug. 8, 1979; minimum daily, 0.0°C on many days during winter.
EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--Specific conductance of 354 microsiemens was measured Feb. 3, 1988.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
02...	1430	2430	333	8.24	9.5	0.60	10.4	92	K2	<1
DEC										
02...	1400	3550	321	8.17	3.5	0.40	12.6	98	<1	<3
FEB										
03...	1200	2400	354	7.90	1.0	0.60	13.1	94	<1	K1
APR										
06...	1030	3350	298	8.07	4.0	1.6	12.4	98	<1	<1
JUL										
22...	1030	1110	311	8.37	25.0	1.4	7.7	96	23	49
AUG										
25...	1100	1160	273	8.33	23.5	0.40	7.2	88	K2	K18

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
02...	160	2	47	11	4.5	6	0.2	0.70	196	0
DEC										
02...	160	13	47	11	4.6	6	0.2	0.80	184	0
FEB										
03...	170	10	48	11	4.7	6	0.2	0.70	189	0
APR										
06...	150	8	42	10	4.1	6	0.2	0.60	168	0
JUL										
22...	150	0	41	12	5.0	7	0.2	0.50	183	3
AUG										
25...	150	14	42	12	4.7	6	0.2	0.40	164	4

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV										
02...	161	10	4.6	0.10	9.0	178	0.24	1170	<0.010	<0.100
DEC										
02...	150	13	5.8	0.30	8.6	182	0.25	1740	<0.010	<0.100
FEB										
03...	155	12	5.7	0.20	9.5	185	0.25	1200	<0.010	0.110
APR										
06...	138	11	4.9	0.10	7.7	154	0.21	1390	<0.010	<0.100
JUL										
22...	154	11	6.5	0.10	8.8	187	0.25	560	<0.010	0.210
AUG										
25...	140	11	5.2	0.10	10	174	0.24	545	<0.010	<0.100

04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)
NOV 02...	0.020	<0.010	0.40	<0.010	<0.010	<0.010	<10	1	20	<0.5
DEC 02...	0.020	0.020	0.60	0.010	<0.010	<0.010	10	1	24	<0.5
FEB 03...	0.020	<0.010	<0.20	0.010	<0.010	<0.010	--	--	--	--
APR 06...	0.010	0.010	0.20	0.010	<0.010	<0.010	<10	1	23	<0.5
JUL 22...	0.040	0.030	0.50	0.020	0.020	0.010	--	--	--	--
AUG 25...	0.050	0.040	0.30	0.020	0.020	<0.010	10	2	26	<0.5

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)
NOV 02...	<1	<1	<3	4	9	<5	5	1	<0.1	<10
DEC 02...	<1	1	<3	3	8	<5	5	2	<0.1	<10
FEB 03...	--	--	--	--	--	--	--	--	--	--
APR 06...	<1	<1	<3	2	13	<5	18	6	<0.1	<10
JUL 22...	--	--	--	--	--	--	--	--	--	--
AUG 25...	<1	1	<3	2	8	<5	5	4	0.1	<10

DATE	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 02...	1	<1	<1.0	73	<6	7	11	72	52
DEC 02...	2	<1	<1.0	71	<6	9	7	67	54
FEB 03...	--	--	--	--	--	--	5	32	53
APR 06...	5	<1	<1.0	63	<6	3	4	36	--
JUL 22...	--	--	--	--	--	--	6	18	87
AUG 25...	<1	<1	1.0	75	<6	26	6	19	75

04142000 RIFLE RIVER NEAR STERLING, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°04'21", long 84°01'12", in NE1/4 SW1/4 sec.5, T.19 N., R.4 E., Arenac County, Hydrologic Unit 04080101, on left bank 30 ft downstream from bridge on Old M-70, 2.8 mi north of Sterling, and 20 mi upstream from mouth.

DRAINAGE AREA.--320 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--November 1905 to December 1908 (gage heights and discharge measurements only), October 1936 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as Rifle River at Michigan Highway 70 near Sterling 1936-61.

REVISED RECORDS.--WSP 1437: 1937(M), 1939-40(M).

GAGE.--Water-stage recorder. Datum of gage is 649.48 ft above National Geodetic Vertical Datum of 1929. November 1905 to December 1908, nonrecording gage at site 400 ft downstream at different datum. Jan. 13, 1937, to Jan. 10, 1939, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 22 and Dec. 27 to Mar. 24. Water-discharge records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station.

AVERAGE DISCHARGE.--52 years, 313 ft³/s, 13.28 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,340 ft³/s, Mar. 28, 1950, gage height, 13.74 ft, from rating curve extended above 3,800 ft³/s; minimum, 75 ft³/s, Nov. 22, 1964, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,600 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 1	1500	ice jam	*8.76	Apr. 4	1200	1,880	6.97
Mar. 31	0800	*2,340	8.04				

Minimum discharge, 127 ft³/s, July 9, 10, gage height, 1.22 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	280	249	569	210	900	170	1560	336	185	143	156	150
2	253	243	437	200	500	165	1130	300	199	143	149	144
3	245	251	365	190	400	165	1480	288	189	142	144	142
4	237	257	328	180	320	165	1840	277	191	143	145	148
5	242	255	302	175	260	165	1480	270	182	138	166	360
6	226	256	281	170	230	170	1190	264	178	134	258	260
7	217	249	274	170	210	180	1200	255	170	132	204	201
8	209	280	267	170	205	360	948	257	167	130	167	180
9	203	356	368	175	200	440	706	287	183	129	178	168
10	195	313	514	180	200	460	603	348	179	137	226	159
11	209	277	426	180	200	500	540	326	171	210	206	153
12	232	258	506	180	200	480	492	274	167	179	176	152
13	219	255	490	180	200	430	452	271	162	154	165	198
14	210	250	411	180	200	390	483	273	160	173	159	179
15	204	240	379	180	205	360	495	256	157	191	150	158
16	227	235	369	180	210	330	437	248	154	166	149	153
17	257	235	372	190	210	310	403	238	154	161	173	152
18	237	241	362	200	205	300	382	229	152	155	170	156
19	224	239	353	210	200	295	363	223	150	155	154	163
20	241	234	376	220	200	290	343	222	144	150	146	273
21	321	213	396	220	195	290	337	224	140	146	144	271
22	336	215	396	210	195	290	319	228	169	150	141	215
23	370	224	381	200	190	310	387	225	215	158	140	225
24	370	239	371	190	190	450	491	215	177	167	154	207
25	358	258	412	185	180	870	438	205	164	158	177	187
26	308	306	454	180	175	1190	392	200	154	243	184	175
27	312	303	360	185	175	913	383	202	148	210	179	170
28	324	297	310	190	175	656	442	198	149	175	168	167
29	299	372	270	200	175	683	419	194	149	166	159	162
30	280	580	240	300	---	1590	377	192	145	158	151	160
31	262	---	220	550	---	2150	---	187	---	165	150	---
TOTAL	8107	8180	11579	6330	7105	15517	20512	7712	5004	4961	5188	5588
MEAN	262	273	374	204	245	501	684	249	167	160	167	186
MAX	370	580	569	550	900	2150	1840	348	215	243	258	360
MIN	195	213	220	170	175	165	319	187	140	129	140	142
CFSM	.82	.85	1.17	.64	.77	1.57	2.14	.78	.52	.50	.52	.58
IN.	.94	.95	1.35	.74	.83	1.80	2.38	.90	.58	.58	.60	.65

CAL YR 1987 TOTAL 95005 MEAN 260 MAX 1430 MIN 122 CFSM .81 IN 11.04
WTR YR 1988 TOTAL 105783 MEAN 289 MAX 2150 MIN 129 CFSM .90 IN 12.30

04142000 RIFLE RIVER NEAR STERLING, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966-72, 1974 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.
SUSPENDED-SEDIMENT DISCHARGE: April to September 1966, October 1969 to September 1970, April to September 1972.

INSTRUMENTATION.--Water-quality monitor from Aug. 28, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-77, 1979-80): Maximum recorded (more than 20 percent missing record), 567 microsiemens, Sept. 6, 1979; minimum, 157 microsiemens, Aug. 31, 1975, but may have been lower during instrument malfunction Sept. 1-10, 1975.
WATER TEMPERATURE (water years 1976-77, 1980): Maximum, 30.5°C, July 20, 1977; minimum, 0.0°C on many days during winter.
SEDIMENT CONCENTRATION (water years 1970, 1972): Maximum daily mean, 304 mg/L, Apr. 13, 1972; minimum daily, 0 mg/L on several days in water year 1972.
SEDIMENT LOAD (water years 1970, 1972): Maximum daily, 1,760 tons, Apr. 13, 1972; minimum daily, 0 ton on several days during 1972.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A suspended-sediment concentration of 647 mg/L was measured Mar. 27, 1967, and a sediment load of 3,270 tons was calculated Mar. 27, 1967.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
21...	1200	346	442	8.15	9.0	2.2	11.2	99	K1300	6700
MAR										
08...	1130	317	416	8.06	0.5	5.8	13.5	97	K72	590
APR										
28...	1130	438	410	8.20	7.5	2.3	11.2	97	K58	K43
JUN										
16...	1330	149	466	8.30	21.5	1.2	8.8	100	K49	--
AUG										
10...	1215	254	425	8.34	22.0	10	8.4	98	270	87

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
21...	220	39	62	15	9.3	8	0.3	1.5	217	0
MAR										
08...	200	36	55	14	9.4	9	0.3	2.7	194	0
APR										
28...	200	31	56	14	8.6	9	0.3	1.4	204	0
JUN										
16...	230	29	63	17	10	9	0.3	1.0	241	0
AUG										
10...	220	36	60	16	9.5	9	0.3	0.90	218	1

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
21...	178	20	13	0.20	7.9	247	0.34	231	<0.010	0.130
MAR										
08...	159	28	14	0.10	8.8	237	0.32	203	0.010	0.410
APR										
28...	167	35	12	0.20	5.9	239	0.33	283	<0.010	0.260
JUN										
16...	198	30	14	0.20	7.9	256	0.35	103	0.010	0.390
AUG										
10...	180	28	12	0.10	9.1	245	0.33	168	<0.010	0.210

04142000 RIFLE RIVER NEAR STERLING, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT										
21...	0.010	0.020	0.40	<0.010	<0.010	<0.010	<10	2	45	<0.5
MAR										
08...	0.280	0.260	1.0	0.070	0.050	0.040	10	1	44	<0.5
APR										
28...	0.050	0.070	0.60	0.030	0.021	<0.010	30	2	39	<0.5
JUN										
16...	0.050	0.040	0.40	0.020	0.010	--	<10	4	54	<0.5
AUG										
10...	--	0.030	0.70	0.110	0.040	<0.010	20	4	56	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT										
21...	<1	2	<3	6	47	<5	<4	12	<0.1	<10
MAR										
08...	<1	<1	<3	2	62	<5	<4	15	<0.1	<10
APR										
28...	<1	<1	<3	5	95	<5	9	21	<0.1	<10
JUN										
16...	<1	<1	<3	2	23	<5	10	14	0.1	<10
AUG										
10...	1	<1	<3	1	18	<5	8	7	0.3	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT									
21...	<1	<1	1.0	230	<6	11	38	35	68
MAR									
08...	5	<1	1.0	200	<6	3	33	28	62
APR									
28...	<1	<1	<1.0	200	<6	25	27	32	14
JUN									
16...	<1	<1	<1.0	--	<6	39	28	11	79
AUG									
10...	<1	<1	1.0	230	<6	20	42	29	85

04143900 SHIAWASSEE RIVER AT LINDEN, MI

LOCATION.--Lat 42°48'56", long 83°48'08", in SW1/4 sec.19, T.5 N., R.6 E., Genesee County, Hydrologic Unit 04080203, on right bank at upstream side of bridge on Hogan Road, 1.0 mi west of Linden.

DRAINAGE AREA.--83.7 mi².

PERIOD OF RECORD.--October 1967 to current year.

REVISED RECORDS.--WDR MI-87: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 844.96 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 15, Jan. 22-28, and Feb. 3-14, 21, 22, 25, 26. Records good except for estimated daily discharges, which are fair and those for July through September, which are poor. Flow regulated by dam at Linden since 1967. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--21 years, 60.4 ft³/s, 9.80 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 476 ft³/s, Apr. 22, 1975, gage height, 7.43 ft; minimum, 0.74 ft³/s, May 22, 23, 1971; minimum gage height, 2.82 ft, Aug. 2, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 164 ft³/s, Dec. 8, gage height, 5.68 ft; minimum daily, 5.2 ft³/s, June 26, July 5, 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	35	67	118	105	70	65	94	47	20	5.8	10	20
2	29	70	121	100	69	66	93	47	20	5.7	11	20
3	26	69	125	97	70	67	93	49	20	5.5	11	20
4	20	69	121	94	71	66	95	52	20	5.4	11	20
5	22	64	120	90	73	64	93	56	19	5.2	12	20
6	24	52	111	87	75	63	97	52	14	5.2	33	20
7	29	50	115	83	76	62	106	41	14	5.4	55	19
8	24	61	143	79	78	64	104	41	14	6.8	58	18
9	22	60	75	70	79	72	107	40	14	6.6	42	13
10	22	54	66	67	79	73	108	36	14	6.2	24	12
11	22	40	73	66	79	78	118	35	14	7.0	22	12
12	21	37	82	65	79	85	120	36	14	6.8	22	12
13	22	43	85	63	79	93	123	34	14	6.1	23	12
14	27	47	88	60	78	98	125	34	14	7.0	23	12
15	30	45	104	57	78	107	126	33	14	7.8	23	14
16	33	41	119	55	77	112	120	33	14	9.0	23	14
17	29	44	126	55	74	115	82	34	14	10	23	14
18	30	46	129	54	73	116	71	35	14	8.6	24	14
19	30	41	130	51	73	116	74	39	14	9.5	26	15
20	36	18	132	52	71	111	79	38	13	8.2	25	20
21	42	13	135	50	71	105	82	31	6.4	8.3	25	23
22	35	19	128	52	72	102	82	30	6.1	8.5	25	24
23	42	38	130	55	73	102	82	23	5.8	9.1	25	50
24	44	54	133	57	72	100	77	27	5.6	8.5	24	58
25	49	76	135	60	72	82	70	26	5.3	9.5	21	55
26	47	111	135	64	73	82	63	25	5.2	18	21	58
27	59	125	133	67	75	85	57	23	5.4	8.6	21	63
28	63	120	123	70	72	84	54	23	5.6	7.0	21	77
29	61	117	118	72	67	85	49	21	5.8	6.3	20	100
30	63	116	115	74	---	89	47	21	5.7	7.1	20	105
31	63	---	110	77	---	89	---	21	---	10	20	---
TOTAL	1101	1807	3578	2148	2148	2698	2691	1088	364.9	238.7	744	934
MEAN	35.5	60.2	115	69.3	74.1	87.0	89.7	35.1	12.2	7.70	24.0	31.1
MAX	63	125	143	105	79	116	126	56	20	18	58	105
MIN	20	13	66	50	67	62	47	21	5.2	5.2	10	12
CFSM	.42	.72	1.37	.83	.89	1.04	1.07	.42	.15	.09	.29	.37
IN.	.49	.80	1.59	.95	.95	1.20	1.20	.48	.16	.11	.33	.42

CAL YR 1987 TOTAL 19783.1 MEAN 54.2 MAX 143 MIN 3.1 CFSM .65 IN 8.79
WTR YR 1988 TOTAL 19540.6 MEAN 53.4 MAX 143 MIN 5.2 CFSM .64 IN 8.68

04144500 SHIAWASSEE RIVER AT OWOSSO, MI

LOCATION.--Lat 43°00'54", long 84°10'52", in SW1/4 sec.12, T.7 N., R.2 E., Shiawassee County, Hydrologic Unit 04080203, on right bank on grounds of sewage-treatment plant, 1.5 mi north of Owosso.

DRAINAGE AREA.--538 mi².

PERIOD OF RECORD.--March 1931 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1904, 1910-30 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1307: 1949(M). WSP 1337: 1932, 1934, 1936-38, 1944.

GAGE.--Water-stage recorder. Datum of gage is 707.25 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 15, 1933, at site 1.5 mi upstream at datum 5.46 ft higher.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 30 and Feb. 6 to Mar. 8. Records good except for estimated daily discharges, which are poor. Flow regulated below about 800 ft³/s by powerplant at Shiawasseetown prior to February 1953; occasional regulation at low stages since. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--57 years, 338 ft³/s, 8.53 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,240 ft³/s, Apr. 6, 1947, gage height, 10.35 ft; minimum, 0.2 ft³/s, July 27, 1934, gage height, 1.12 ft; minimum daily, 2.0 ft³/s, July 28, 1934.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 21	0100	1,780	6.01	Apr. 7	0900	*2,070	*6.48

Minimum discharge, 19 ft³/s, July 11; minimum gage height, 2.01 ft, July 11, 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	137	221	614	400	791	440	465	323	91	52	96	81
2	138	219	608	380	645	480	451	301	97	53	79	79
3	135	226	563	350	617	485	531	283	99	50	64	102
4	131	247	531	330	538	480	741	270	92	44	68	90
5	125	252	507	310	483	460	687	244	89	39	72	90
6	117	248	490	300	420	430	865	236	86	35	68	77
7	106	244	473	280	380	470	1950	229	81	31	71	70
8	103	235	501	260	380	565	1580	223	75	27	90	66
9	104	219	649	250	380	733	1330	216	81	25	122	71
10	99	188	734	240	375	731	1240	214	86	22	123	73
11	95	183	680	230	375	697	1170	200	81	20	125	71
12	93	206	653	220	360	758	1040	195	75	21	130	69
13	87	206	621	210	350	1020	867	186	77	25	127	67
14	86	199	570	200	350	940	712	177	71	27	114	65
15	75	186	547	190	350	880	631	170	61	28	100	61
16	78	184	679	180	360	796	590	170	64	32	97	60
17	81	178	785	200	380	732	580	163	67	82	88	59
18	94	174	800	400	390	715	565	166	72	65	108	60
19	88	173	825	550	390	701	534	165	70	63	110	71
20	94	189	1280	650	370	664	477	162	68	68	115	93
21	92	197	1630	760	350	628	413	152	63	68	128	71
22	98	191	1290	650	380	594	378	152	55	64	119	95
23	112	162	1130	550	480	543	457	144	61	69	137	306
24	129	136	1100	500	560	497	471	130	66	95	129	364
25	149	284	1130	450	510	493	448	110	60	74	124	291
26	157	612	1020	380	470	512	426	83	55	64	122	267
27	183	590	921	350	410	505	396	71	59	92	116	234
28	194	543	845	320	405	488	368	94	58	115	112	212
29	204	589	770	310	400	459	346	113	51	117	106	197
30	213	631	560	540	---	476	335	107	49	109	95	189
31	216	---	420	756	---	485	---	98	---	111	81	---
TOTAL	3813	8112	23926	11696	12649	18857	21044	5547	2160	1787	3236	3701
MEAN	123	270	772	377	436	608	701	179	72.0	57.6	104	123
MAX	216	631	1630	760	791	1020	1950	323	99	117	137	364
MIN	75	136	420	180	350	430	335	71	49	20	64	59
CFSM	.23	.50	1.44	.70	.81	1.13	1.30	.33	.13	.11	.19	.23
IN.	.26	.56	1.65	.81	.87	1.30	1.46	.38	.15	.12	.22	.26

CAL YR 1987 TOTAL 105460 MEAN 289 MAX 1630 MIN 30 CFSM .54 IN 7.29
WTR YR 1988 TOTAL 116528 MEAN 318 MAX 1950 MIN 20 CFSM .59 IN 8.06

04146000 FARMERS CREEK NEAR LAPEER, MI

LOCATION.--Lat 43°02'41", long 83°20'14", in sec.6, T.7 N., R.10 E., Lapeer County, Hydrologic Unit 04080204, on left bank on grounds of sewage-treatment plant at Michigan Home and Training School, 2.0 mi west of Lapeer.

DRAINAGE AREA.--55.3 mi².

PERIOD OF RECORD.--October 1932 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 924: 1940. WSP 1084: 1942(M), 1943. WSP 1337: 1934-38, 1940(M), 1944(M), 1945, 1946(M), 1948-51(M). WSP 1727: 1952 (M). WDR MI-78: Drainage area.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 805.79 ft above National Geodetic Vertical Datum of 1929. Prior to May 25, 1954, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 29 to Jan. 19 and Feb. 3-7, 12-17. Records good except for estimated daily discharges, which are fair. Prior to 1941, occasional regulation caused by dam upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--56 years, 31.6 ft³/s, 7.76 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,380 ft³/s, Sept. 9, 1985, gage height, 20.95 ft, from floodmark; minimum not determined.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 128 ft³/s, Mar. 12, gage height, 16.53 ft, no peak discharge above base discharge of 160 ft³/s; maximum gage height, 16.59 ft, Mar. 15, backwater from ice; minimum discharge, 0.39 ft³/s, July 6, 7, gage height, 14.93 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	59	79	48	46	35	61	35	4.3	.64	13	3.4
2	15	79	75	42	43	36	59	23	4.9	.69	10	3.2
3	16	81	71	36	53	37	62	14	4.5	.54	8.2	3.1
4	16	68	67	31	58	37	72	13	4.2	.48	6.5	4.0
5	14	55	61	28	53	36	82	13	3.9	.54	7.1	5.7
6	13	46	56	26	45	37	102	11	3.7	.45	13	5.7
7	13	39	51	24	44	42	122	9.1	3.4	.45	16	5.3
8	13	35	50	22	38	53	121	7.6	3.1	.48	16	5.0
9	12	32	54	20	35	73	125	8.7	2.9	.55	14	4.5
10	11	29	54	19	31	90	118	8.0	2.7	1.8	12	4.1
11	11	28	60	18	29	108	102	6.8	2.6	.73	9.7	3.7
12	10	27	65	17	28	119	87	6.0	2.5	.55	8.9	3.6
13	9.9	26	65	17	27	123	75	5.2	2.4	.54	8.0	3.8
14	9.6	25	62	16	27	120	66	4.6	2.1	.46	7.0	3.8
15	9.5	24	66	15	35	120	59	4.8	2.0	.50	5.8	3.6
16	9.4	23	69	17	31	104	54	5.7	1.8	1.1	4.8	3.2
17	8.8	22	73	20	29	90	50	4.9	1.6	7.2	4.5	3.1
18	9.6	22	76	25	38	80	46	4.4	1.3	4.7	4.5	3.4
19	13	22	76	31	39	73	42	3.9	1.1	5.5	4.2	3.5
20	19	22	96	43	39	68	41	3.7	1.1	5.4	3.8	5.0
21	22	21	97	47	33	64	40	4.0	1.1	4.8	3.5	6.2
22	24	20	112	45	45	61	37	4.7	.93	4.4	3.1	6.1
23	26	20	125	42	47	59	44	4.1	.91	4.3	3.5	9.2
24	27	20	122	36	47	58	42	3.6	.64	4.6	4.3	11
25	27	41	111	31	45	58	43	3.1	.58	6.7	4.8	12
26	26	46	97	29	46	62	42	3.0	.69	12	4.5	11
27	31	58	84	25	42	66	41	2.9	.76	13	3.9	9.5
28	32	75	78	25	37	67	39	3.1	.61	14	3.9	8.0
29	35	84	70	26	36	67	37	3.2	.60	12	4.0	6.7
30	47	82	65	28	---	66	35	3.9	.58	11	3.7	6.3
31	56	---	55	40	---	64	---	4.2	---	13	3.4	---
TOTAL	600.8	1231	2342	890	1146	2173	1946	232.2	63.50	133.10	219.6	166.7
MEAN	19.4	41.0	75.5	28.7	39.5	70.1	64.9	7.49	2.12	4.29	7.08	5.56
MAX	56	84	125	48	58	123	125	35	4.9	14	16	12
MIN	8.8	20	50	15	27	35	35	2.9	.58	.45	3.1	3.1
CFSM	.35	.74	1.37	.52	.71	1.27	1.17	.14	.04	.08	.13	.10
IN.	.40	.83	1.58	.60	.77	1.46	1.31	.16	.04	.09	.15	.11

CAL YR 1987 TOTAL 11561.00 MEAN 31.7 MAX 130 MIN 2.2 CFSM .57 IN 7.78
WTR YR 1988 TOTAL 11143.90 MEAN 30.4 MAX 125 MIN .45 CFSM .55 IN 7.50

04146063 SOUTH BRANCH FLINT RIVER NEAR COLUMBIAVILLE, MI

LOCATION.--Lat 43°09'34", long 83°21'03", in NE1/4 NE1/4 sec.36, T.9 N., R.9 E., Lapeer County, Hydrologic Unit 04080204, on right bank at upstream side of bridge on Columbiaville Road, 3.0 mi east of Columbiaville, and 3.2 mi upstream from confluence of North and South Branches.

DRAINAGE AREA.--221 mi².

PERIOD OF RECORD.--March 1980 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 765 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30 to Mar. 7. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--8 years, 195 ft³/s, 11.98 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,090 ft³/s, Sept. 9, 1985, gage height, 9.60 ft; maximum gage height, 9.61 ft, Feb. 26, 1985, backwater from ice; minimum discharge, 12 ft³/s, July 11, 1988, gage height, 1.22 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 716 ft³/s, Dec. 21, gage height, 4.32 ft; minimum, 12 ft³/s, July 11, gage height, 1.22 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	82	161	354	200	250	145	280	167	42	19	90	37
2	78	188	332	175	240	160	267	150	49	18	72	32
3	73	204	307	155	230	190	272	130	53	19	63	34
4	70	192	290	140	215	175	474	118	48	18	60	35
5	68	166	256	120	205	160	530	113	45	19	57	50
6	66	149	226	110	185	160	478	105	42	18	85	50
7	64	132	201	99	170	210	543	96	40	18	106	43
8	63	122	200	90	150	299	581	89	38	17	91	39
9	64	123	274	84	140	464	498	87	38	17	79	36
10	63	115	311	79	130	533	444	84	35	15	75	34
11	67	109	278	74	120	509	377	83	37	15	68	31
12	63	105	281	71	115	524	309	83	34	15	61	30
13	60	102	283	69	105	606	271	78	31	15	63	30
14	57	98	258	67	105	594	246	69	30	17	63	30
15	56	95	255	66	110	469	242	67	29	17	54	30
16	53	95	373	66	115	436	222	98	27	16	52	29
17	52	94	385	80	120	375	219	87	26	72	52	28
18	55	101	360	115	130	334	194	81	26	75	45	30
19	57	108	344	150	140	316	182	78	25	54	43	50
20	62	108	406	160	145	287	164	71	25	44	39	46
21	79	100	646	170	140	257	169	68	23	41	35	48
22	87	92	639	165	135	241	167	69	25	40	33	49
23	101	90	538	155	155	236	229	69	26	39	37	60
24	110	90	516	140	170	288	282	64	24	53	47	66
25	133	175	508	130	175	313	240	58	24	43	42	67
26	125	461	467	120	175	344	215	55	21	108	45	71
27	145	440	387	110	170	332	191	50	19	84	38	67
28	181	355	328	105	160	326	180	49	18	71	40	66
29	156	350	297	110	155	309	173	49	19	64	39	56
30	146	369	270	150	---	295	172	47	18	59	38	51
31	152	---	235	210	---	289	---	43	---	93	37	---
TOTAL	2688	5089	10805	3735	4555	10196	8811	2555	937	1213	1749	1325
MEAN	86.7	170	349	120	157	329	294	82.4	31.2	39.1	56.4	44.2
MAX	181	461	646	210	250	606	581	167	53	108	106	71
MIN	52	90	200	66	105	145	164	43	18	15	33	28
CFSM	.39	.77	1.58	.54	.71	1.49	1.33	.37	.14	.18	.26	.20
IN.	.45	.86	1.82	.63	.77	1.72	1.48	.43	.16	.20	.29	.22

CAL YR 1987 TOTAL 56972 MEAN 156 MAX 646 MIN 35 CFSM .71 IN 9.59
WTR YR 1988 TOTAL 53658 MEAN 147 MAX 646 MIN 15 CFSM .67 IN 9.03

04147000 HOLLOWAY RESERVOIR NEAR OTISVILLE, MI

LOCATION.--Lat 43°07'15", long 83°29'45", in NW1/4 sec.11, T.8 N., R.8 E., Genesee County, Hydrologic Unit 04080204, in gatehouse on right side of Holloway Dam on Flint River, 3.5 mi southeast of Otisville.

DRAINAGE AREA.--526 mi².

PERIOD OF RECORD.--March 1954 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by City of Flint).

REMARKS.--Reservoir is formed by an earth-fill dam with concrete spillway completed in 1953. Capacity of reservoir, 1,256,000,000 ft³ at elevation 760.00 ft. The spillway section includes two 90-foot drum gates with minimum crest elevation of 751 ft, maximum at 755 ft, three 20-foot radial gates with sill elevation of 745 ft, and 2 sluices (each 4 by 6 ft), one on each side with valve controls. Entrance elevation of sluiceways is 724 ft. Reservoir is used to regulate flow for sewage dilution for City of Flint.

COOPERATION.--Reservoir elevations furnished by City of Flint.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 996,000,000 ft³, Mar. 8, 1956, elevation, 757.4 ft; minimum, reservoir empty at times during October, November, 1954, January, February, 1955, October, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 800,000,000 ft³, Oct. 29, 31, elevation, 755.33 ft; minimum, 442,000,000 ft³, Sept. 18, elevation, 750.49 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

Date	Elevation (feet)	Contents (millions of cubic feet)	Change in contents (millions of cubic feet)	Change in contents (equivalent in ft³/s)
Sept. 30	755.08	777	--	--
Oct. 31	755.33	800	+23	+8.6
Nov. 30	752.02	538	-262	-101
Dec. 31	751.30	491	-47	-17.5
CAL YR 1987	--	--	-14	-0.4
Jan. 31	751.62	510	+19	+7.1
Feb. 29	751.44	499	-11	-4.4
Mar. 31	751.53	505	+6	+2.2
Apr. 30	755.29	796	+291	+112
May 31	754.89	760	-36	-13.4
June 30	754.29	710	-50	-19.3
July 31	754.27	709	-1	-0.4
Aug. 31	754.51	728	+19	+7.1
Sept. 30	750.65	452	-276	-106
WTR YR 1988	--	--	-325	-10.3

04147500 FLINT RIVER NEAR OTISVILLE, MI

LOCATION.--Lat 43°06'40", long 83°31'10", in SE1/4 sec.9, T.8 N., R.8 E., Genesee County, Hydrologic Unit 04080204, on left bank 20 ft downstream from bridge on State Highway 15, 1.5 mi downstream from Holloway Reservoir, 3.5 mi upstream from Powers-Cullen Drain, and 3.8 mi south of Otisville.

DRAINAGE AREA.--530 mi².

PERIOD OF RECORD.--October 1952 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 721.39 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Holloway Reservoir, 1.5 mi upstream from station (see preceding page). Several measurements of water temperature were made during the year. City of Flint gage-height telemeter at station.

AVERAGE DISCHARGE.--36 years, 325 ft³/s, 8.33 in/yr, adjusted for storage since 1954.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,150 ft³/s, Apr. 1, 1960, gage height, 14.97 ft; minimum, 2.1 ft³/s, Oct. 11, 12, 1971, gage height, 1.57 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,630 ft³/s, Dec. 23, gage height, 9.48 ft; minimum, 36 ft³/s, Nov. 11, gage height, 2.19 ft; minimum daily, 56 ft³/s, June 25.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	137	532	916	562	499	343	687	384	119	95	70	79
2	137	653	872	485	607	343	656	367	124	93	71	79
3	137	605	856	408	568	366	641	336	118	93	71	79
4	127	593	817	258	564	373	777	298	110	92	71	79
5	121	736	764	187	534	367	956	267	109	91	72	79
6	123	816	702	206	453	370	1080	253	108	91	72	167
7	121	955	626	218	370	422	1360	238	109	90	72	490
8	114	946	567	214	339	558	1410	218	107	89	72	669
9	107	933	567	199	332	835	1300	206	103	88	74	539
10	114	457	668	187	307	1070	1160	209	93	90	74	535
11	111	122	694	175	292	1240	1030	207	90	89	74	528
12	111	225	724	167	276	1390	911	195	90	82	74	522
13	111	279	760	166	253	1520	589	187	86	73	74	518
14	107	250	748	164	245	1420	428	186	84	74	75	373
15	106	228	760	162	253	1300	344	171	72	70	75	132
16	105	214	779	159	272	1190	292	192	68	64	76	95
17	105	206	840	172	295	1040	329	193	66	65	76	79
18	112	208	855	234	311	922	362	193	64	64	80	66
19	117	248	872	307	332	835	370	190	63	64	77	66
20	132	266	964	348	353	773	245	180	63	64	75	71
21	138	234	1270	396	336	712	108	176	63	65	76	60
22	149	214	1520	408	316	646	108	177	59	64	76	58
23	174	195	1590	397	348	589	115	173	58	68	76	82
24	207	199	1450	372	411	600	110	164	57	67	75	112
25	238	311	1310	330	433	630	82	144	56	67	75	112
26	259	536	1210	301	431	685	82	134	57	67	75	111
27	301	732	1090	269	417	723	204	129	57	69	75	112
28	341	800	1000	237	388	751	326	129	72	69	77	113
29	358	854	889	232	356	730	390	127	95	69	77	113
30	352	895	679	241	---	721	399	123	95	70	77	112
31	354	---	539	323	---	720	---	119	---	70	78	---
TOTAL	5226	14442	27898	8484	10891	24184	16851	6265	2515	2366	2312	5230
MEAN	169	481	900	274	376	780	562	202	83.8	76.3	74.6	208
MAX	358	955	1590	562	607	1520	1410	384	124	95	80	669
MIN	105	122	539	159	245	343	82	119	56	64	70	58
MEAN‡	177	380	882	281	371	782	674	189	64.5	75.9	61.7	102
CFSM‡	.33	.72	1.66	.53	.70	1.48	1.27	.36	.12	.14	.15	.19
IN‡	.39	.80	1.92	.61	.76	1.70	1.42	.41	.14	.17	.18	.21

CAL YR 1987 TOTAL 124860 MEAN 342 MAX 1590 MIN 47 MEAN+ 342 CFSM+ .64 IN+ 8.75
WTR YR 1988 TOTAL 127664 MEAN 349 MAX 1590 MIN 56 MEAN+ 339 CFSM+ .64 IN+ 8.69

‡ Adjusted for change in contents in Holloway Reservoir.

04148140 KEARSLEY CREEK NEAR DAVISON, MI

LOCATION.--Lat 43°02'01", long 83°34'53", in NE1/4 sec.12, T.7 N., R.7 E., Genesee County, Hydrologic Unit 04080204, on right bank 10 ft upstream from bridge on Davison Road, 1.4 mi downstream from Black Creek, and 3.3 mi west of Davison.

DRAINAGE AREA.--99.4 mi².

PERIOD OF RECORD.--October 1965 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area. WDR MI-85: 1968(M), 1973(M), 1975, 1982(P).

GAGE.--Water-stage recorder. Datum of gage is 747.39 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 30 to Mar. 8. Records good except for estimated daily discharges, and those for the period Apr. 4-7, which are fair. Some diurnal fluctuation caused by small dams, and occasional diversion for sprinkler irrigation upstream from station. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--23 years, 72.7 ft³/s, 9.93 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft³/s, Sept. 9, 1985, gage height, 11.85 ft, from floodmark; minimum, 1.6 ft³/s, July 9, 1988, gage height, 2.62 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 350 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 20	2000	*397	*7.70	Apr. 7	--	375	7.51
Mar. 13	0400	352	7.30				

Minimum discharge, 1.6 ft³/s, July 9, gage height, 2.62 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19	47	139	62	120	75	106	64	15	3.0	15	3.4
2	20	43	129	56	115	78	100	60	16	2.7	12	3.0
3	20	43	117	51	110	84	108	56	14	2.6	9.4	4.2
4	19	45	111	47	100	71	257	50	14	2.5	8.2	10
5	17	43	100	45	96	73	223	40	14	2.6	28	16
6	18	38	90	43	90	78	227	31	13	2.4	37	12
7	18	35	82	41	82	84	347	33	11	2.1	26	14
8	18	34	80	39	86	125	290	34	10	2.2	27	13
9	20	32	117	37	83	223	250	35	11	2.1	21	11
10	25	29	129	35	80	218	214	36	10	2.2	16	8.9
11	25	29	141	34	67	222	177	34	8.5	2.4	18	7.6
12	25	28	151	33	64	250	145	31	8.2	2.7	23	7.2
13	26	27	125	31	60	311	122	30	8.2	2.7	20	8.3
14	26	26	111	30	60	237	112	28	8.2	2.4	17	7.4
15	24	24	140	29	62	203	102	29	6.3	2.3	13	6.8
16	25	24	185	28	65	189	90	37	5.4	3.1	11	6.5
17	25	25	157	38	67	150	86	31	4.7	22	11	6.7
18	20	28	150	55	70	153	82	30	3.9	6.0	12	7.8
19	21	26	144	70	73	137	75	30	4.8	7.3	12	8.1
20	28	27	312	76	76	121	76	28	4.1	12	13	16
21	27	27	318	76	82	105	75	26	3.6	13	13	11
22	30	26	250	74	90	98	67	26	3.5	11	10	12
23	34	24	247	70	110	97	112	26	3.9	11	14	29
24	39	23	230	53	100	107	118	25	3.5	11	18	24
25	41	133	209	56	95	114	104	23	2.9	7.6	29	41
26	39	140	179	52	86	128	96	21	2.7	18	21	48
27	59	125	157	49	80	127	85	20	2.7	28	14	40
28	48	133	140	47	77	122	78	19	2.7	31	9.8	31
29	51	150	110	47	72	120	75	18	3.0	25	5.3	26
30	55	149	86	65	---	118	68	16	2.9	26	3.9	22
31	50	---	73	85	---	113	---	16	---	26	3.7	---
TOTAL	912	1583	4709	1564	2418	4331	4067	983	221.7	294.9	491.3	461.9
MEAN	29.4	52.8	152	50.5	83.4	140	136	31.7	7.39	9.51	15.8	15.4
MAX	59	150	318	85	120	311	347	64	16	31	37	48
MIN	17	23	73	28	60	71	67	16	2.7	2.1	3.7	3.0
CFSM	.30	.53	1.53	.51	.84	1.41	1.37	.32	.07	.10	.16	.16
IN.	.34	.59	1.76	.59	.90	1.62	1.52	.37	.08	.11	.18	.17

CAL YR 1987 TOTAL 20641.8 MEAN 56.6 MAX 318 MIN 4.7 CFSM .57 IN 7.73
WTR YR 1988 TOTAL 22036.8 MEAN 60.2 MAX 347 MIN 2.1 CFSM .61 IN 8.25

04148500 FLINT RIVER NEAR FLINT, MI

LOCATION.--Lat 43°02'20", long 83°46'18" (revised), in SW1/4 sec.4, T.7 N., R.6 E., Genesee County, Hydrologic Unit 04080204, on left bank on grounds of sewage-treatment plant, 1.2 mi upstream from Pirnie Creek, and 5.0 mi downstream from Swartz Creek.

DRAINAGE AREA.--956 mi^2.

PERIOD OF RECORD.--September 1903 to March 1904 (gage heights only), August 1932 to current year. Gage-height records for flood seasons collected in this vicinity 1911-32, are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 954: 1941. WSP 1337: 1933-34(M), 1935-37. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 678.80 ft above National Geodetic Vertical Datum of 1929 (levels by the National Weather Service and City of Flint).

REMARKS.--No estimated daily discharges. Records good. Some regulation by reservoirs upstream from station (station 04147000). Occasional diversion for industrial use. Since Dec. 17, 1967, flow contains up to 50 ft^3/s as sewage effluent which originates outside the basin. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--56 years, 615 ft^3/s, 8.74 in/yr, adjusted for storage since 1954.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,900 ft^3/s, Apr. 6, 1947, gage height, 16.35 ft; maximum gage height, 16.95 ft, Sept. 6, 1985; minimum discharge, 9.0 ft^3/s, Aug. 7, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,480 ft^3/s, Apr. 7, gage height, 8.87 ft; minimum daily, 95 ft^3/s, June 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	295	647	1550	854	1190	717	1160	701	206	131	143	128
2	269	866	1470	822	1130	746	1100	661	332	129	136	127
3	262	880	1390	739	1040	823	1170	606	220	126	128	161
4	234	735	1330	650	984	770	1600	576	186	127	125	149
5	236	908	1200	391	912	728	1770	515	176	132	358	252
6	236	921	1090	406	808	743	2270	482	182	139	324	144
7	232	1160	1000	403	691	875	3190	442	184	135	198	327
8	226	1210	1020	379	588	1180	2830	412	187	132	170	775
9	211	1190	1280	359	597	1820	2370	410	192	128	204	643
10	210	1030	1320	337	571	1930	1960	425	170	125	158	590
11	207	334	1210	327	533	2010	1810	411	156	129	130	607
12	212	253	1300	315	560	2550	1580	382	152	138	240	584
13	211	433	1290	305	492	3180	1290	370	158	130	245	600
14	206	436	1240	286	465	2640	945	353	160	120	151	577
15	205	383	1460	296	636	2310	892	338	154	122	147	310
16	196	365	1720	275	531	2080	656	412	150	138	168	174
17	197	389	1570	434	590	1820	660	370	140	574	161	146
18	196	402	1490	906	638	1640	722	350	125	166	234	158
19	207	353	1510	726	773	1530	692	346	119	141	150	183
20	312	445	2690	710	612	1300	682	333	119	127	133	325
21	282	391	2880	760	637	1240	441	315	127	220	125	173
22	305	363	2590	713	739	1120	372	314	129	202	133	155
23	363	356	2550	691	1020	1010	969	316	127	216	281	699
24	446	348	2510	658	963	1090	722	301	112	201	175	253
25	447	1640	2340	610	846	1160	490	259	100	157	162	208
26	449	1450	2090	562	806	1270	429	235	95	153	155	223
27	751	1190	1770	498	744	1240	465	229	100	133	149	230
28	629	1230	1710	438	678	1240	645	227	105	243	178	250
29	599	1440	1460	429	695	1220	727	218	111	144	141	204
30	578	1520	1110	548	---	1280	726	208	125	210	136	189
31	576	---	923	860	---	1250	---	211	---	241	130	---
TOTAL	9985	23268	50063	16735	21469	44512	35335	11728	4599	5209	5468	9544
MEAN	322	776	1615	540	740	1436	1178	378	153	168	176	318
MAX	751	1640	2880	906	1190	3180	3190	701	332	574	358	775
MIN	196	253	923	275	465	717	372	208	95	120	125	127
MEAN+	331	675	1597	547	736	1438	1290	365	134	168	183	212
CFSM+	.35	.71	1.67	.57	.77	1.50	1.35	.38	.14	.18	.19	.22
IN+	.40	.79	1.93	.66	.83	1.73	1.51	.44	.16	.20	.22	.25

CAL YR 1987 TOTAL 232562 MEAN 637 MAX [illegible] MIN 94 MEAN+ 637 CFSM+ .67 IN+ 9.04
WTR YR 1988 TOTAL 237915 MEAN 650 MAX [illegible] MIN 95 MEAN+ 640 CFSM+ .67 IN+ 9.11

+ Adjusted for change in contents in Holloway Reservoir.

04149000 FLINT RIVER NEAR FOSTERS, MI

LOCATION.--Lat 43°18'30", long 83°57'13", in SE1/4 SE1/4 sec.35, T.11 N., R.4 E., Saginaw County, Hydrologic Unit 04080204, on left bank 20 ft downstream from bridge on State Highway 13, 2 mi west of Fosters, and 6.5 mi downstream from Silver Creek. Records include flow of Birch Run.

DRAINAGE AREA.--1,188 mi^2, includes that of Birch Run upstream from State Highway 13.

PERIOD OF RECORD.--October 1939 to September 1984, October 1987 to September 1988. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1910-20, 1922-27 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 954: 1941. WSP 1337: 1940, 1942, 1943-44(M), 1945, 1946-47(M), 1948-50. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 600 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Oct. 1, 1969, nonrecording gage at site 2.2 mi upstream at datum 582.22 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 30 to Mar. 4, Aug. 6-31, and Sept. 5-9. Records good except for estimated daily discharges, which are fair. Some regulation by reservoirs upstream from the city of Flint. Several observations of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 744 ft^3/s, 8.50 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,000 ft^3/s, Apr. 7, 1947 (including flow by-passing gage); maximum gage height, 18.6 ft, Feb. 2, 1968, site and datum then in use; minimum discharge observed, 27 ft^3/s, Aug. 6, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of March 1904, reached a stage of 18.4 ft from National Weather Service data, site and datum then in use.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,320 ft^3/s, Apr. 7, gage height, 12.80 ft; minimum, 102 ft^3/s, June 27, gage height, 1.48 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	437	615	1900	1150	1150	840	1480	831	295	152	311	197
2	366	754	2000	1100	1500	900	1370	788	301	164	213	185
3	346	877	1800	1000	1350	940	1370	739	418	157	202	177
4	316	848	1700	900	1250	980	2120	692	304	151	182	197
5	285	795	1600	750	1200	859	2140	655	265	149	180	220
6	283	910	1500	480	1100	859	2100	611	247	152	450	320
7	280	957	1350	500	970	1010	3810	564	248	164	400	200
8	274	1130	1250	500	840	1300	3920	522	251	159	260	600
9	264	1170	1200	470	720	2010	2990	490	260	153	230	800
10	251	1140	1550	440	740	2260	2420	529	261	151	270	644
11	245	864	1650	420	700	2120	2030	533	238	147	205	604
12	244	411	1500	400	660	2330	1860	495	218	148	180	614
13	246	360	1600	390	700	3590	1660	459	211	160	300	614
14	244	504	1600	380	600	3360	1310	440	213	152	310	617
15	246	488	1550	350	580	2660	1150	416	216	136	210	572
16	241	443	1900	370	800	2370	1000	427	203	154	200	359
17	235	430	2100	350	650	2160	849	471	198	416	220	244
18	237	471	1900	600	750	1940	874	436	185	528	215	208
19	233	457	1850	1100	850	1830	888	414	171	243	290	217
20	262	442	2000	900	950	1690	846	413	157	198	200	300
21	382	501	3300	880	750	1470	827	402	154	184	180	382
22	354	448	3500	950	850	1410	607	388	162	283	170	242
23	388	423	3200	870	950	1290	821	389	176	268	210	453
24	428	417	3100	850	1250	1280	1360	391	168	320	350	637
25	545	710	3000	800	1150	1340	913	377	145	329	230	336
26	520	2080	2800	750	1000	1520	690	336	127	234	215	284
27	588	1510	2500	680	980	1500	620	310	111	222	210	284
28	799	1270	2200	600	940	1420	672	307	121	205	200	295
29	684	1290	2100	540	900	1410	815	309	127	302	240	307
30	643	1800	1800	530	---	1490	855	298	128	206	220	269
31	622	---	1200	700	---	1600	---	290	---	300	200	---
TOTAL	11488	24515	62200	20700	26830	51738	44367	14722	6279	6687	7453	11378
MEAN	371	817	2006	668	925	1669	1479	475	209	216	240	379
MAX	799	2080	3500	1150	1500	3590	3920	831	418	528	450	800
MIN	233	360	1200	350	580	840	607	290	111	136	170	177

WTR YR 1988 TOTAL 288357 MEAN 788 MAX 3920 MIN 111

04150500 CASS RIVER AT CASS CITY, MI

LOCATION.--Lat 43°35'03", long 83°10'34", in NE1/4 NE1/4 sec.4, T.13 N., R.11 E., Tuscola County, Hydrologic Unit 04080205, on left bank 600 ft downstream from bridge on Cemetery Road, 0.3 mi downstream from confluence of North and South Branches, and 1.1 mi south of Cass City.

DRAINAGE AREA.--359 mi^2.

PERIOD OF RECORD.--October 1947 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1337: 1949-50. WSP 1727: 1948(M), 1950. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 697.92 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 14, 1952, nonrecording gage at site 600 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 27 to Mar. 9, and Mar. 18-21. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--41 years, 219 ft^3/s, 8.28 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,500 ft^3/s, Sept. 12, 1986, gage height, 19.82 ft, from floodmarks; minimum, 0.50 ft^3/s, Sept. 26, 1948.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 21	1300	*2,910	10.58	Mar. 13	1400	1,550	8.57
Mar. 9	--	2,840	*[a]11.25	Apr. 4	1900	1,920	9.15

[a] Ice jam.

Minimum discharge, 2.3 ft^3/s, July 11, gage height, 4.39 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	17	97	506	90	640	74	434	140	31	5.6	113	4.6
2	20	81	471	75	400	74	351	126	30	5.2	151	4.2
3	17	74	368	65	300	75	334	112	28	5.8	104	4.4
4	16	70	281	60	200	76	1370	101	34	6.8	50	12
5	15	68	231	55	140	82	1300	94	31	6.7	33	149
6	15	63	190	50	100	90	746	85	26	6.4	29	176
7	15	58	162	45	90	200	909	78	22	5.8	24	124
8	15	58	145	40	80	500	759	74	23	5.7	20	70
9	15	65	340	37	70	1200	487	74	19	4.6	19	41
10	16	76	800	34	65	1930	351	78	19	3.3	16	28
11	15	72	544	32	60	1080	274	78	18	2.7	15	23
12	12	65	440	30	56	839	227	71	15	4.5	14	17
13	13	60	424	30	56	1390	192	67	14	4.9	11	15
14	11	57	336	30	60	842	183	63	13	4.4	10	13
15	11	55	289	32	64	585	209	65	12	3.3	16	11
16	11	52	531	35	70	403	197	72	11	2.7	20	10
17	11	48	743	45	76	293	182	76	9.9	3.3	16	9.3
18	10	51	539	150	82	255	183	75	8.6	4.0	13	8.4
19	9.6	53	403	370	86	230	175	71	8.3	7.2	9.6	9.7
20	15	56	763	300	82	220	157	66	8.1	10	7.9	18
21	33	52	2610	200	80	205	159	63	7.5	6.5	6.6	21
22	63	48	1520	130	82	195	146	62	7.2	6.0	5.6	19
23	104	48	866	90	100	189	241	58	6.5	5.7	5.3	23
24	125	48	649	80	150	311	437	52	5.8	33	5.4	24
25	143	68	1040	70	188	402	340	48	6.2	162	7.4	26
26	143	562	998	60	120	586	251	41	7.0	86	7.9	24
27	150	648	600	54	90	577	199	37	6.9	61	7.1	17
28	213	360	300	50	84	434	179	40	6.6	48	7.6	14
29	214	298	200	50	78	375	167	38	6.1	37	6.7	13
30	157	421	150	60	---	462	157	34	6.0	36	5.6	12
31	119	---	110	150	---	510	---	31	---	59	5.0	---
TOTAL	1743.6	3832	17549	2599	3749	14684	11296	2170	446.7	643.1	761.7	940.6
MEAN	56.2	128	566	83.8	129	474	377	70.0	14.9	20.7	24.6	31.4
MAX	214	648	2610	370	640	1930	1370	140	34	162	151	176
MIN	9.6	48	110	30	56	74	146	31	5.8	2.7	5.0	4.2
CFSM	.16	.36	1.58	.23	.36	1.32	1.05	.20	.04	.06	.07	.09
IN.	.18	.40	1.82	.27	.39	1.52	1.17	.22	.05	.07	.08	.10

CAL YR 1987 TOTAL 68215.9 MEAN 187 MAX 2810 MIN 3.7 CFSM .52 IN 7.07
WTR YR 1988 TOTAL 60414.7 MEAN 165 MAX 2610 MIN 2.7 CFSM .46 IN 6.26

04150800 CASS RIVER AT WAHJAMEGA, MI

LOCATION.--Lat 43°27'02", long 83°26'29", in NW1/4 NW1/4 sec.20, T.12 N., R.9 E., Tuscola County, Hydrologic Unit 04080205, on right bank 90 ft upstream from bridge on Chambers Road, on grounds of Caro Regional Center at Wahjamega, 1.9 mi downstream from Michigan Sugar Co. dam, and 40 mi upstream from mouth.

DRAINAGE AREA.--645 mi^2.

PERIOD OF RECORD.--October 1968 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 632.60 ft above National Geodetic Vertical Datum of 1929 (levels by Edmonds Engineering, Inc.). Prior to June 19, 1969, nonrecording gage at bridge 90 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 16, 21, 22, 26-29, Feb. 4-19, 21, 22, Feb. 28 to Mar. 6 and Mar. 17-23. Records good except for estimated daily discharges, which are poor. Some regulation by dam at Michigan Sugar Co., 1.9 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--20 years, 455 ft^3/s, 9.58 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,000 ft^3/s, Sept. 12, 1986, gage height, 26.66 ft, from floodmarks; minimum, 16 ft^3/s, July 14-16, 1988, gage height, 2.80 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 22	0400	4,220	12.39	Mar. 13	1900	2,720	10.05
Mar. 10	0200	*4,370	*12.53	Apr. 5	0500	2,910	10.25

Minimum discharge, 16 ft^3/s, July 14-16, gage height, 2.80 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	88	227	944	310	1170	245	882	384	72	23	122	27
2	87	203	883	270	998	245	755	340	89	22	161	26
3	85	189	735	230	603	250	720	305	80	22	172	26
4	77	182	598	210	400	255	1670	278	72	21	126	32
5	73	170	501	190	350	260	2540	259	73	20	87	61
6	69	156	428	170	300	290	1510	239	70	20	76	249
7	68	147	371	150	270	484	1740	218	62	20	59	210
8	66	151	340	135	240	1100	1610	203	57	20	51	155
9	61	163	414	125	220	2990	1070	213	61	20	46	108
10	60	177	1180	115	210	3780	801	293	57	19	45	77
11	55	177	1070	110	200	2160	658	263	54	19	43	59
12	56	168	811	105	190	1600	562	223	53	18	42	51
13	54	159	779	103	185	2460	491	201	51	18	41	47
14	51	151	684	101	190	1880	466	178	47	17	41	42
15	48	145	595	102	210	1110	521	163	44	17	45	37
16	45	140	645	110	230	895	509	171	42	17	46	34
17	46	136	1090	129	250	640	473	168	39	19	50	33
18	46	142	997	351	260	580	465	163	38	16	49	35
19	46	146	777	680	270	530	450	155	36	17	42	38
20	62	149	813	638	289	500	410	150	34	17	39	49
21	112	139	2780	450	255	470	412	146	33	17	36	54
22	177	130	3690	370	260	450	396	139	32	18	34	55
23	239	130	1860	343	322	430	488	132	32	18	32	79
24	277	133	1270	266	402	624	886	125	31	19	30	68
25	303	179	1340	233	429	791	774	113	30	21	30	61
26	300	607	2000	195	380	1050	595	105	29	62	29	60
27	313	1060	1430	170	313	1100	488	98	29	118	29	55
28	394	721	1030	160	265	897	456	93	28	97	29	49
29	395	584	817	170	250	770	433	91	27	76	29	40
30	330	739	450	209	---	883	413	84	24	88	28	38
31	266	---	370	555	---	1030	---	77	---	118	27	---
TOTAL	4349	7700	31692	7455	9911	30749	23644	5770	1426	1036	1716	1955
MEAN	140	257	1022	240	342	992	788	186	47.5	33.4	55.4	65.2
MAX	395	1060	3690	680	1170	3780	2540	384	89	118	172	249
MIN	45	130	340	101	185	245	396	77	24	17	27	26
CFSM	.22	.40	1.58	.37	.53	1.54	1.22	.29	.07	.05	.09	.10
IN.	.25	.44	1.83	.43	.57	1.77	1.36	.33	.08	.06	.10	.11

CAL YR 1987 TOTAL 128040 MEAN 351 MAX 4160 MIN 20 CFSM .54 IN 7.38
WTR YR 1988 TOTAL 127403 MEAN 348 MAX 3780 MIN 17 CFSM .54 IN 7.35

04151500 CASS RIVER AT FRANKENMUTH, MI

LOCATION.--Lat 43°19'40", long 83°44'53", in NW1/4 SE1/4 sec.27, T.11 N., R.6 E., Saginaw County, Hydrologic Unit 04080205, on right bank 2,000 ft downstream from dam in Frankenmuth, 3,600 ft upstream from highway bridge on Dehmel Road, 3.4 mi upstream from Dead Creek, and 17 mi upstream from mouth.

DRAINAGE AREA.--841 mi².

PERIOD OF RECORD.--February 1908 to March 1909, July 1935 to September 1936, June 1939 to current year.

REVISED RECORDS.--WSP 1307: 1936(M), 1940(M). WSP 1727: 1952. WSP 1911: 1952. WDR MI-78: Drainage area.

GAGE--Water-stage recorder. Datum of gage is 583.96 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). February 1908 to March 1909, nonrecording gage at site 2,000 ft upstream at datum 1.81 ft lower. July 18 to September 11, 1935, nonrecording gage, Sept. 12, 1935, to Sept. 30, 1936, June 20, 1939, to Sept. 30, 1949, water-stage recorder, at site 3,600 ft downstream at datum 0.04 ft higher.

REMARKS.--Estimated daily discharges: Dec. 29 to Jan. 15, 26-29, Feb. 3 to Mar. 10 and Mar. 18-21. Records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station. Prior to 1950, regulation at low and medium flows by mill upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--50 years, 515 ft³/s, 8.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,200 ft³/s, Sept. 12, 1986, gage height, 27.52 ft; minimum daily, about 1.5 ft³/s, Aug. 6, 1944.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 22	0800	*4,740	15.30	Mar. 10	--	4,630	*a17.47

a Ice jam.

Minimum discharge, 15 ft³/s. June 10, 11; minimum gage height, 2.87 ft, June 11, when gates in dam at Frankenmuth were closed.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	131	298	1200	430	1340	320	1140	497	104	39	109	37
2	123	270	1210	380	1610	310	959	454	104	38	123	35
3	118	253	1030	330	900	320	911	408	113	36	154	38
4	110	240	842	300	600	330	1490	382	105	35	154	42
5	100	234	696	270	500	340	2760	352	97	34	134	71
6	93	215	592	240	420	370	2160	332	97	33	105	99
7	90	200	515	220	370	450	2290	307	94	34	82	244
8	91	196	480	200	340	800	2200	279	87	33	67	192
9	86	219	573	180	320	2000	1550	269	86	31	63	144
10	82	230	1140	170	300	4200	1110	364	101	30	60	103
11	78	244	1460	165	280	3300	874	414	37	31	57	80
12	77	230	1140	160	260	2180	730	348	70	31	63	69
13	77	220	1030	160	250	2810	626	304	68	30	56	63
14	73	215	918	160	250	2790	580	270	68	30	55	58
15	71	202	811	160	260	1680	627	244	63	29	52	56
16	70	194	853	179	290	1290	642	237	63	37	54	51
17	70	191	1220	204	310	976	594	235	61	76	54	49
18	69	200	1310	462	340	820	571	222	56	56	54	49
19	69	208	1050	829	360	760	553	212	52	46	52	55
20	80	215	1320	1060	360	720	515	206	50	39	49	70
21	105	205	3130	946	350	660	507	202	50	37	45	70
22	170	189	4420	751	340	643	501	194	50	38	44	71
23	247	182	2580	594	360	603	589	182	53	39	46	86
24	316	191	1740	465	430	751	1010	172	48	37	46	97
25	354	251	1810	384	510	988	1040	158	45	41	44	85
26	362	556	2360	300	[illegible]	1260	804	146	43	40	41	77
27	368	1150	1840	250	420	1380	648	137	41	59	41	92
28	429	1060	1330	230	380	1190	586	129	36	114	39	87
29	470	808	900	250	350	984	569	120	38	94	38	77
30	429	912	580	331	---	1060	537	115	40	81	38	68
31	355	---	480	614	---	1270	---	109	---	98	38	---
TOTAL	5363	9980	40560	11394	13280	37555	29673	8020	2020	1426	2057	2415
MEAN	173	333	1308	368	458	1211	989	259	67.3	46.0	66.4	80.5
MAX	470	1150	4420	1060	1610	4200	2760	497	113	114	154	244
MIN	69	182	480	160	250	310	501	109	36	29	38	35
CFSM	.21	.40	1.56	.44	.55	1.44	1.18	.31	.08	.06	.08	.10
IN.	.24	.44	1.79	.50	.59	1.66	1.31	.35	.09	.06	.09	.11

CAL YR 1987 TOTAL 171638 MEAN 470 MAX 5020 MIN 34 CFSM .56 IN 7.59
WTR YR 1988 TOTAL 163743 MEAN 447 MAX 4420 MIN 29 CFSM .53 IN 7.24

STREAMS TRIBUTARY TO LAKE HURON

04152238 SOUTH BRANCH TOBACCO RIVER NEAR BEAVERTON, MI

LOCATION.--Lat 43°5[illegible]'01", long 84°32'43", in SE1/4 NE1/4 sec.16, T.17 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, on left bank 40 ft upstream from bridge on Grout Road, 3.0 mi upstream from Ross Lake and 3.2 mi southwest of Beaverton.

DRAINAGE AREA.--160 mi^2.

PERIOD OF RECORD.--January 1987 to current year.

GAGE.--Water stage recorder. Datum of gage is 709.92 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 27 to Mar. 21, and Apr. 7 to May 12. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 901 ft^3/s, Mar. 31, 1988, gage height, 9.41 ft; maximum gage height, 10.64 ft, Feb. 1, 1988, backwater from ice; minimum discharge, 39 ft^3/s, July 6, Sept. 9, 1988; minimum gage height, 3.26 ft, July 6, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 901 ft^3/s, Mar. 31, gage height, 9.41 ft; maximum gage height, 10.64 ft, Feb. 1, backwater from ice; minimum discharge, 39 ft^3/s, July 6, Sept. 9; minimum gage height, 3.26 ft, July 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	91	100	404	100	400	70	631	115	70	47	50	47
2	89	102	294	90	220	68	358	105	71	46	47	45
3	90	111	207	80	160	66	520	100	72	43	45	48
4	89	109	167	75	120	66	768	95	72	42	45	63
5	85	104	144	70	100	66	739	92	72	42	46	99
6	84	101	128	70	90	68	462	90	72	40	57	107
7	83	99	117	70	85	70	370	90	64	40	56	74
8	83	98	118	70	83	90	330	90	56	41	51	62
9	83	101	226	70	82	130	290	95	61	42	53	49
10	81	103	309	72	80	160	260	120	52	41	78	52
11	80	100	230	72	80	200	230	110	61	48	64	49
12	80	96	261	72	80	190	210	100	58	63	64	47
13	79	95	238	72	80	170	190	95	57	53	82	47
14	79	94	187	72	80	150	180	93	54	45	70	45
15	79	90	172	72	82	130	170	90	54	44	67	43
16	78	89	181	72	84	125	160	89	52	49	58	42
17	78	89	163	75	84	120	150	86	51	52	61	44
18	81	91	152	80	82	120	140	81	52	51	61	51
19	82	96	147	84	80	120	130	80	51	52	59	55
20	88	95	160	88	78	115	125	76	49	50	55	112
21	109	90	205	90	78	115	120	77	47	46	51	158
22	145	86	208	88	78	114	115	80	50	47	48	111
23	157	86	183	80	78	116	160	80	58	48	50	98
24	158	93	166	74	76	188	190	77	57	69	55	113
25	161	97	186	72	72	262	165	73	54	68	54	83
26	137	128	225	72	70	387	140	72	49	64	50	71
27	129	136	160	74	70	296	150	71	47	61	47	57
28	138	123	140	76	70	209	160	70	46	53	48	57
29	129	163	130	80	70	227	140	70	48	50	48	56
30	112	318	120	120	---	578	125	70	48	48	47	56
31	105	---	110	250	---	872	---	70	---	51	47	---
TOTAL	3142	3283	5838	2602	2892	5658	7878	2702	1715	1536	1714	2041
MEAN	101	109	188	83.9	99.7	183	263	87.2	57.2	49.5	55.3	68.0
MAX	161	318	404	250	400	872	768	120	72	69	82	158
MIN	78	86	110	70	70	66	115	70	46	40	45	42
CFSM	.63	.68	1.18	.52	.62	1.14	1.64	.55	.36	.31	.35	.43
IN.	.73	.76	1.36	.60	.67	1.32	1.83	.63	.40	.36	.40	.47

CAL YR 1987 TOTAL 39651 MEAN 109 MAX 404 MIN 58 CFSM .68 IN 9.22
WTR YR 1988 TOTAL 41001 MEAN 112 MAX 872 MIN 40 CFSM .70 IN 9.53

04154000 CHIPPEWA RIVER NEAR MOUNT PLEASANT, MI

LOCATION.--Lat 43°37'32", long 84°42'28", in NW1/4 NW1/4 sec.8, T.14 N., R.3 W., Isabella County, Hydrologic Unit 04080202, on right bank 12 ft downstream from bridge on South Leaton Road, 3.8 mi northeast of Mount Pleasant, and 36 mi upstream from mouth.

DRAINAGE AREA.--416 mi².

PERIOD OF RECORD.--October 1930 to September 1931, October 1932 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1910-27, are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 744: Drainage area. WSP 1337: 1931, 1933-40, 1945, 1948-49.

GAGE.--Water-stage recorder. Datum of gage is 710.38 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 21, 1938, nonrecording gage at site 30 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 30 to Mar. 4. Records good except for estimated daily discharges, which are poor. Diurnal fluctuation below 750 ft³/s caused by powerplant at Mount Pleasant prior to 1962, occasional regulation at low flow since. Since July 30, 1968, occasional regulation by control structures on lake outlets. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--57 years, 316 ft³/s, 10.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft³/s, Sept. 12, 1986, gage height, 15.58 ft, from floodmarks; minimum, 12 ft³/s, Aug. 18, 1945; minimum gage height, 2.70 ft, Oct. 8, 1966; minimum daily discharge, 19 ft³/s, Aug. 16, 1936.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 1	--	1,370	*a10.44	Apr. 4	1900	*1,480	7.08
Mar. 31	0500	1,260	6.43				

a Ice jam.

Minimum discharge, 94 ft³/s, July 10, gage height, 2.85 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	260	349	578	350	1200	320	821	422	179	112	145	129
2	254	347	482	310	1000	320	895	396	178	112	139	126
3	246	344	424	290	800	310	1120	371	166	112	131	134
4	239	337	399	280	600	310	1390	351	156	112	124	158
5	235	328	375	270	500	306	1360	336	158	112	119	221
6	227	318	356	260	450	323	1260	324	158	110	126	281
7	220	311	345	260	420	367	1220	313	158	109	130	291
8	215	308	347	260	400	405	1090	303	158	105	130	249
9	211	308	487	265	390	616	958	303	163	102	154	218
10	208	303	547	270	380	504	842	304	160	99	159	194
11	200	298	454	270	380	471	742	308	155	112	165	175
12	200	292	487	270	370	526	662	309	151	99	232	165
13	200	290	466	270	370	680	601	304	147	100	264	161
14	199	285	423	270	370	531	577	289	144	103	217	156
15	196	282	421	270	370	469	547	281	137	101	193	147
16	258	279	416	270	380	439	519	276	137	109	176	141
17	285	275	401	290	390	416	490	272	132	126	163	139
18	283	272	374	310	400	418	461	264	131	118	183	144
19	282	267	392	320	390	415	425	254	130	115	154	171
20	325	262	459	330	380	398	404	245	129	112	144	258
21	382	255	540	340	370	384	395	239	122	112	139	306
22	382	256	510	340	360	379	376	237	124	127	133	311
23	407	253	465	310	360	376	510	236	133	117	141	359
24	411	252	457	280	360	412	635	226	126	165	147	347
25	428	267	547	270	350	445	597	213	125	159	147	314
26	398	290	587	270	340	544	561	206	123	204	141	275
27	395	293	475	270	330	517	513	203	113	184	134	246
28	390	294	434	280	320	482	518	196	113	168	135	225
29	375	346	409	300	320	492	483	191	117	154	132	207
30	361	515	400	500	---	841	450	188	115	152	129	198
31	350	---	360	900	---	1150	---	185	---	154	127	---
TOTAL	9022	9076	13817	9745	13050	14566	21422	8545	4238	3876	4753	6446
MEAN	291	303	446	314	450	470	714	276	141	125	153	215
MAX	428	515	587	900	1200	1150	1390	422	179	204	264	359
MIN	196	252	345	260	320	306	376	185	113	99	119	126
CFSM	.70	.73	1.07	.76	1.08	1.13	1.72	.65	.34	.30	.37	.52
IN.	.81	.81	1.24	.87	1.17	1.30	1.92	.76	.38	.35	.43	.58

CAL YR 1987 TOTAL 105557 MEAN 289 MAX 656 MIN 106 CFSM .70 IN 9.44
WTR YR 1988 TOTAL 118556 MEAN 324 MAX 1390 MIN 99 CFSM .78 IN 10.60

04155000 PINE RIVER AT ALMA, MI

LOCATION.--Lat 43°22'46", long 84°39'20", in SW1/4 SE1/4 sec.34, T.12 N., R.3 W., Gratiot County, Hydrologic Unit 04080202, on right bank 270 ft downstream from Superior Street Bridge in Alma, 0.6 mi downstream from municipal reservoir, and 38 mi upstream from mouth.

DRAINAGE AREA.--288 mi^2.

PERIOD OF RECORD.--October 1930 to current year. Gage-height records for flood seasons collected in this vicinity 1910-28 are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 744: Drainage area. WSP 1307: 1945(M). WSP 1337: 1931, 1932-34(M), 1936, 1939, 1945, 1949.

GAGE.--Water-stage recorder. Datum of gage is 718.37 ft above National Geodetic Vertical Datum of 1929. Prior to Dec. 10, 1930, nonrecording gage at Superior Street Bridge at different datum. Dec. 10, 1930, to June 15, 1938, nonrecording gage at site 70 ft downstream from bridge, and June 16 to Oct. 25, 1938, nonrecording gage at bridge at present datum.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 29, Feb. 9-17, 20-25, and Mar. 2-4. Records fair except for estimated daily discharges, which are poor. Flow regulated by dam 0.6 mi upstream from station, and by variable backwater from powerplant at St. Louis, 5.2 mi downstream. About 4.1 ft^3/s diverted upstream from station for municipal and industrial use; sewage effluent is returned downstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--58 years, 221 ft^3/s, 10.42 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,160 ft^3/s, Sept. 12, 1986, gage height, 12.82 ft, from floodmarks; minimum daily, 0.40 ft^3/s, Sept. 6, 1964, caused by closing dam during construction of waterworks.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,070 ft^3/s, Apr. 7, gage height, 5.73 ft; minimum, 3.2 ft^3/s, July 9, 10, gage height, 0.41 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	120	169	338	180	669	227	621	311	146	47	105	37
2	145	142	371	150	615	225	701	283	140	49	79	29
3	124	160	378	135	910	220	787	262	103	35	46	29
4	112	188	364	125	872	210	873	239	83	22	42	49
5	121	152	319	120	639	209	797	233	84	19	38	91
6	134	149	280	115	523	224	843	228	92	15	32	95
7	116	139	261	115	406	262	1020	209	99	9.9	24	118
8	108	135	251	115	312	308	843	202	109	8.6	20	105
9	114	152	294	115	270	448	722	204	127	5.5	22	105
10	104	153	316	115	240	479	620	224	141	5.8	26	45
11	110	136	327	120	220	564	533	232	109	12	41	34
12	114	129	391	120	210	641	469	219	82	13	53	72
13	104	145	374	120	210	668	404	214	73	17	56	60
14	96	142	331	115	210	548	389	196	69	16	60	33
15	109	142	353	115	210	515	331	192	65	16	60	34
16	110	139	303	120	215	519	336	135	58	26	51	32
17	90	137	263	130	220	404	329	177	53	54	28	39
18	92	135	258	135	227	350	291	171	50	77	27	40
19	108	134	274	140	227	305	281	166	47	101	27	71
20	114	132	361	145	215	311	277	178	39	97	30	127
21	104	152	486	150	205	298	272	177	33	61	31	148
22	112	168	465	150	200	256	266	169	31	58	30	176
23	136	156	449	140	200	272	355	151	31	58	38	199
24	142	141	445	130	200	302	406	141	31	63	45	177
25	134	155	545	120	195	339	430	155	31	81	55	178
26	144	179	499	120	186	361	484	172	24	111	63	170
27	180	220	425	120	169	392	486	129	20	114	61	147
28	159	250	418	125	195	432	408	111	19	86	58	116
29	162	277	380	130	248	443	339	105	22	80	53	96
30	139	310	310	237	---	553	334	116	29	72	49	84
31	157	---	220	722	---	583	---	137	---	95	44	---
TOTAL	3814	4918	11049	4689	9418	11838	15247	5888	2040	1524.8	1394	2744
MEAN	123	164	356	151	325	382	508	190	68.0	49.2	45.0	91.5
MAX	180	310	545	722	910	668	1020	311	146	114	105	199
MIN	90	129	220	115	169	209	266	105	19	5.5	20	29
CFSM	.43	.57	1.24	.52	1.13	1.33	1.76	.66	.24	.17	.16	.32
IN.	.49	.64	1.43	.61	1.22	1.53	1.97	.76	.26	.20	.18	.35

CAL YR 1987 TOTAL 70134.0 MEAN 192 MAX 636 MIN 40 CFSM .67 IN 9.06
WTR YR 1988 TOTAL 74563.8 MEAN 204 MAX 1020 MIN 5.5 CFSM .71 IN 9.63

04155500 PINE RIVER NEAR MIDLAND, MI

LOCATION.--Lat 43°33'52", long 84°22'09", in SW1/4 NW1/4 sec.4, T.13 N., R.1 E., Midland County, Hydrologic Unit 04080202, on left bank at downstream side of bridge on Meridian Road, 7.2 mi southwest of Midland, and 7.8 mi upstream from Chippewa River.

DRAINAGE AREA.--390 mi², approximately.

PERIOD OF RECORD.--May 1934 to September 1938, February 1948 to current year.

REVISED RECORDS.--WSP 1207: Drainage area. WSP 1307: 1935(M). WSP 1337: 1936-38, 1948-49.

GAGE.--Water-stage recorder. Datum of gage is 623.94 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1938, nonrecording gage at same site at datum 5.55 ft lower. Feb. 3, 1948, to Dec. 13, 1951, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Dec. 31 to Feb. 1, Feb. 7 to Mar. 13 and Mar. 17, 21, 22. Records good except for estimated daily discharges, which are poor. Regulation at low and medium flows by hydroelectric powerplant at St. Louis. Some diversion upstream from station for irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 307 ft³/s, 10.69 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,360 ft³/s, Sept. 12, 1986, gage height, 11.74 ft; maximum gage height, 12.08 ft, Feb. 2, 1968, backwater from ice; minimum discharge since 1951, 7.6 ft³/s, July 1, 2, 1988; minimum daily discharge, 7.8 ft³/s, July 2, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 1	--	1,520	*a6.35	Apr. 4	2200	1,390	4.97
Feb. 4	1600	*1,990	5.74	Apr. 7	0900	1,650	5.32

a Ice jam.

Minimum discharge, 7.6 ft³/s, July 1, 2, gage height, 1.95 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	194	132	551	300	1500	330	728	409	84	9.2	57	68
2	106	314	470	250	1410	340	826	366	168	7.8	120	65
3	252	241	485	220	1350	330	985	317	200	44	145	70
4	308	100	469	200	1880	320	1300	313	226	71	77	67
5	110	364	454	195	1730	320	1110	250	124	57	58	72
6	78	198	422	190	1180	350	957	241	81	40	60	94
7	224	207	318	190	700	430	1510	301	76	41	59	126
8	210	204	332	190	500	540	1300	227	75	41	59	179
9	138	154	395	190	430	680	882	276	68	41	60	96
10	188	140	553	195	380	760	834	187	66	44	63	179
11	161	225	547	200	350	880	682	229	123	52	58	131
12	119	136	483	200	330	980	542	275	139	46	85	54
13	204	178	629	200	320	950	547	220	112	35	71	111
14	196	162	586	200	310	850	393	245	69	32	65	169
15	93	176	411	200	310	658	546	204	67	30	66	86
16	76	162	615	205	320	577	336	218	66	37	64	73
17	292	174	398	210	330	480	392	219	66	53	106	59
18	159	162	422	220	330	428	461	219	67	46	90	50
19	56	164	404	230	320	493	302	216	68	45	59	55
20	134	164	534	240	310	320	293	132	70	55	58	68
21	255	139	926	245	300	280	310	188	66	128	60	84
22	279	94	930	245	290	250	306	202	66	83	60	181
23	198	165	792	230	280	250	400	226	67	60	59	206
24	260	179	721	220	270	290	596	195	64	62	58	286
25	395	188	937	210	260	480	562	134	61	64	57	220
26	290	187	1110	200	255	488	522	84	59	68	58	177
27	121	201	853	205	260	487	546	229	62	86	61	175
28	403	257	555	210	280	451	607	179	59	137	67	173
29	210	336	670	220	300	541	456	174	50	87	68	151
30	408	460	767	260	---	771	339	114	19	71	69	147
31	104	---	400	800	---	1030	---	81	---	86	69	---
TOTAL	6201	5963	18139	7270	16785	16334	19570	6870	2588	1759.0	2166	3672
MEAN	200	199	585	235	579	527	652	222	86.3	56.7	69.9	122
MAX	408	460	1110	800	1880	1030	1510	409	226	137	145	286
MIN	56	94	318	190	255	250	293	81	19	7.8	57	50
CFSM	.51	.51	1.50	.60	1.49	1.35	1.67	.57	.22	.15	.18	.31
IN.	.59	.57	1.73	.69	1.60	1.56	1.87	.66	.25	.17	.21	.35

CAL YR 1987 TOTAL 86198.0 MEAN 236 MAX 1110 MIN 13 CFSM .61 IN 8.22
WTR YR 1988 TOTAL 107317.0 MEAN 293 MAX 1880 MIN 7.8 CFSM .75 IN 10.24

04156000 TITTABAWASSEE RIVER AT MIDLAND, MI

LOCATION.--Lat 43°35'43", long 84°14'08", in NW1/4 NE1/4 sec.28, T.14 N., R.2 E., Midland County, Hydrologic Unit 04080201, on right bank 2,000 ft downstream from dam at Dow Chemical Co. in Midland, 0.7 mi upstream from Bullock Creek, 1.4 mi downstream from Chippewa River, and 23 mi upstream from mouth.

DRAINAGE AREA.--2,400 mi², approximately.

PERIOD OF RECORD.--March 1936 to current year. Gage height records for flood seasons collected in this vicinity 1910-26, 1928, and since 1946 are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 1045: 1945. WSP 1144: 1948.

GAGE.--Water-stage recorder. Datum of gage is 580.28 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1955, at datum 10.00 ft higher.

REMARKS.--Estimated daily discharges: Jan. 3-16, 25-29, and Feb. 3 to Mar. 5. Records good except for estimated daily discharges, which are poor. Water is diverted from river a short distance upstream from station for industrial use. Small part returned to river 0.25 mi downstream from station, remainder returned 1 mi downstream. Extremes and daily discharges not adjusted for diversion. Prior to May 20, 1970, discharge below 4,000 ft³/s regulated by dam 2,000 ft upstream from station; fixed crest dam since. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--52 years, 1,731 ft³/s, 9.79 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 38,700 ft³/s, Sept. 13, 1986, gage height, 33.89 ft, from floodmarks; minimum, 39 ft³/s, Oct. 1, 1942; minimum gage height, 8.78 ft, July 2, 3, 1988; minimum daily discharge, 111 ft³/s, Aug. 21, 1949.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 7,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 1	2130	*12,300	*21.81	Apr. 5	0230	11,600	21.33
Mar. 31	1930	12,000	21.61				

Minimum discharge, 158 ft³/s, July 2, 3, gage height, 8.78 ft; minimum daily, 166 ft³/s, July 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1220	698	4340	1190	11100	1400	10400	1680	411	448	595	419
2	1160	1140	4200	1180	9280	1520	6310	1540	429	218	479	416
3	666	1610	3770	1150	3500	1500	7500	1820	467	166	533	332
4	612	1530	3490	1140	2000	1480	10800	1560	512	219	571	290
5	915	1540	3330	1550	1300	950	11100	1280	481	378	593	486
6	907	1380	1970	1650	950	806	8120	1290	532	402	617	805
7	808	1100	1730	1450	850	1100	8320	915	484	395	268	1150
8	834	765	2260	1250	950	1880	6600	806	477	388	384	1550
9	797	1060	2480	1100	1250	4180	5050	1310	621	240	589	1650
10	500	1200	3880	920	1450	4280	4420	1610	629	234	622	436
11	486	1160	3840	940	1500	3860	3940	1640	359	388	621	420
12	766	1350	3590	1150	1300	3870	3530	1380	364	403	1040	491
13	671	1620	3700	1180	1100	4590	3180	1070	477	369	683	472
14	616	1090	3530	1170	900	4060	2820	852	470	379	457	538
15	589	718	3030	1100	850	3330	2950	739	460	377	672	565
16	644	1070	2710	1020	1300	3110	1770	855	457	254	612	584
17	589	1190	2360	1010	1750	2430	1320	1120	456	257	643	345
18	565	1050	2240	1770	1500	2270	2390	999	310	377	526	267
19	686	1140	1860	2380	920	1580	2420	1230	274	410	621	586
20	951	1170	1460	2440	880	1230	1860	1330	404	444	323	924
21	1250	806	3860	2410	850	1460	1640	773	445	500	258	1160
22	1570	603	4540	2110	1100	1990	1570	586	446	486	393	1250
23	1730	1000	3740	1170	1650	1800	1880	820	495	441	432	1390
24	1710	1290	3120	856	1600	2030	3240	1010	550	424	433	1010
25	1380	1720	2600	1100	1560	2440	2970	852	293	615	437	690
26	1510	2180	3060	1200	1630	3830	2880	709	232	669	438	865
27	1820	1430	4120	1150	980	3760	2630	612	374	686	290	726
28	1870	1490	3160	1000	880	3360	2670	550	547	675	263	666
29	1880	1120	2320	900	800	3220	2590	469	427	738	383	771
30	1570	2200	1430	821	---	5370	1990	448	395	418	423	798
31	994	---	1480	3570	---	11300	---	454	---	341	431	---
TOTAL	32266	37420	93200	43027	55680	89986	128860	32309	13278	12759	15630	21452
MEAN	1041	1247	3006	1388	1920	2903	4295	1042	443	412	504	715
MAX	1880	2200	4540	3570	11100	11300	11100	1820	629	738	1040	1550
MIN	486	603	1430	821	800	806	1320	448	232	166	258	267
MEAN+	1052	1258	3020	1396	1933	2917	4310	1052	443	412	504	715
CFSM+	.44	.52	1.26	.58	.80	1.22	1.80	.44	.18	.17	.21	.30
IN+	.50	.58	1.45	.67	.87	1.40	2.00	.50	.21	.20	.24	.33

CAL YR 1987 TOTAL 459454 MEAN 1259 MAX 4590 MIN 207 MEAN+ 1271 CFSM+ .53 IN+ 7.19
WTR YR 1988 TOTAL 575867 MEAN 1573 MAX 11300 MIN 166 MEAN+ 1581 CFSM+ .66 IN+ 8.95

+ Adjusted for diversion; records furnished by Dow Chemical Co.

04156100 TITTABAWASSEE RIVER NEAR MIDLAND, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°34'07", long 84°11'37", in SW1/4 SE1/4 sec.35, T.14 N., R.2 E., Midland County, Hydrologic Unit 04080201; at bridge on Gordonville Road, 3.0 mi downstream from gaging station 04156000, and 20 mi upstream from mouth.

DRAINAGE AREA.--2,450 mi².

PERIOD OF RECORD.--October 1986 to current year.

REMARKS.--Bimonthly cross-sectional samples were collected at or near bridge. Water-discharge measurements were made at time of sampling. All flow except for high-water is regulated by powerplant at Sanford.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 20...	1030	676	729	8.30	11.5	1.9	9.6	90	K660	K690
JAN 14...	1330	754	1100	8.05	0.0	2.1	13.3	91	390	330
MAR 10...	1030	4600	376	8.01	1.0	5.9	12.8	93	K270	3400
APR 27...	1230	2530	776	8.09	12.0	3.1	9.8	95	150	140
JUN 14...	1430	388	1070	8.56	25.0	2.4	9.2	114	1300	150
AUG 09...	1330	340	1060	8.43	27.0	1.3	8.6	111	1800	76

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT 20...	260	86	70	20	54	31	2	2.5	208	0
JAN 14...	340	130	97	24	92	37	2	4.3	253	0
MAR 10...	160	40	44	12	10	12	0.4	3.2	145	0
APR 27...	270	110	76	19	52	29	1	3.8	198	0
JUN 14...	270	94	75	21	110	46	3	3.3	214	3
AUG 09...	250	110	66	20	130	53	4	3.5	167	1

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT 20...	171	38	110	0.20	4.2	414	0.56	756	<0.010	0.140
JAN 14...	207	55	200	0.30	9.7	636	0.86	1290	<0.010	1.00
MAR 10...	119	30	19	0.10	5.9	215	0.29	2670	0.020	0.690
APR 27...	162	40	120	0.20	3.8	453	0.62	3090	0.010	1.20
JUN 14...	180	55	210	0.20	2.5	627	0.85	657	0.030	0.150
AUG 09...	139	46	250	0.20	5.6	592	0.81	543	0.040	0.130

04156100 TITTABAWASSEE RIVER NEAR MIDLAND, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 20...	0.160	0.150	1.0	0.010	<0.010	0.010	<10	1	33	<0.5
JAN 14...	0.390	0.370	1.2	0.050	0.040	<0.010	--	--	--	--
MAR 10...	0.240	0.260	1.4	0.090	0.050	0.030	30	<1	25	<0.5
APR 27...	0.080	0.070	0.90	0.050	0.021	<0.010	50	<1	34	<0.5
JUN 14...	0.240	--	0.90	0.050	0.020	0.010	--	--	--	--
AUG 09...	0.350	0.330	0.90	0.090	0.040	0.010	20	3	44	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 20...	<1	20	<3	2	24	<5	6	11	0.1	<10
JAN 14...	--	--	--	--	--	--	--	--	--	--
MAR 10...	<1	<1	<3	5	140	<5	7	66	<0.1	<10
APR 27...	<1	<1	<3	5	160	<5	14	22	<0.1	<10
JUN 14...	--	--	--	--	--	--	--	--	--	--
AUG 09...	<1	<1	<3	2	11	<5	12	13	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 20...	1	<1	1.0	360	<6	7	11	20	84
JAN 14...	--	--	--	--	--	--	6	12	72
MAR 10...	6	<1	2.0	180	<6	3	24	298	65
APR 27...	<1	<1	<1.0	580	<6	12	17	116	29
JUN 14...	--	--	--	--	--	--	11	12	30
AUG 09...	1	<1	1.0	470	<6	20	8	7.3	81

04157000 SAGINAW RIVER AT SAGINAW, MI

LOCATION.--Lat 43°24'46", long 83°57'47", in NW1/4 SE1/4 sec.26, T.12 N., R.4 E., Saginaw County, Hydrologic Unit 04080206, on right bank 1,000 ft downstream from bridge on Rust Avenue in Saginaw, 1.9 mi downstream from Tittabawassee River, and 20.3 mi upstream from mouth.

DRAINAGE AREA.--6,060 mi^2, approximately.

PERIOD OF RECORD.--1904, 1908-9, 1912-13, 1916, 1918-19, 1929-30, and 1942 (flood discharge for certain periods only) in WSP 1084; December 1942 to current year (high-water periods only); no high water 1944, 1949, 1953, 1955, 1958, 1961, 1963, 1964, 1966. Gage-height records for flood seasons collected in this vicinity 1910-20, and for entire years since 1921 are contained in reports of National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 565.11 ft, International Great Lakes datum. Prior to Oct. 1, 1972, nonrecording gage at site 1.9 mi downstream at same datum. Auxiliary water-stage recorder on right bank near Aplin Beach, 19.9 mi downstream.

REMARKS.--No estimated daily discharges. Records fair; only daily discharges greater than 10,000 ft^3/s are published. Considerable diversion through metropolitan area of Saginaw. National Weather Service gage-height telemeter at station.

COOPERATION.--Auxiliary gage-height record furnished by National Oceanic and Atmospheric Administration.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 68,000 ft^3/s, Mar. 30, 1904, gage height, 24.9 ft, site then in use.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 21,400 ft^3/s, Apr. 8; maximum daily gage height, 16.61 ft, Apr. 8.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1		---	---	12500	12200	10500	16700	---				
2		---	15500	---	16600	11300	16200	---				
3		---	---	---	16700	---	15200	---				
4		---	---	---	14500	12000	16200	---				
5		---	---	---	13200	11200	16100	---				
6		---	---	---	11100	11000	18400	---				
7		---	---	---	---	---	19600	---				
8		---	---	---	---	12200	21400	---				
9		---	---	---	---	14300	20300	---				
10		---	---	---	---	14800	17200	---				
11		---	12100	---	---	15000	14600	---				
12		---	14100	---	---	16000	13100	---				
13		---	11200	---	---	17200	11700	---				
14		---	10000	---	---	16200	10100	---				
15		---	12500	---	---	15300	10000	---				
16		---	---	---	---	13300	---	11300				
17		---	---	---	---	12900	---	---				
18		---	13500	---	10200	13500	10700	---				
19		---	---	---	---	11100	---	---				
20		---	13900	---	---	10400	---	---				
21		---	15400	---	---	---	---	---				
22		---	16400	11200	---	11900	---	---				
23		---	16100	10600	---	---	---	---				
24		---	14900	---	10900	10800	---	---				
25		---	13700	---	10400	---	10300	---				
26		10300	14400	---	10500	15800	---	---				
27		---	13600	---	10100	12000	---	---				
28		---	11900	---	---	12500	---	---				
29		11800	12200	---	---	15100	---	---				
30		14400	12400	---	---	12000	---	---				
31		---	---	11300	---	14900	---	---				

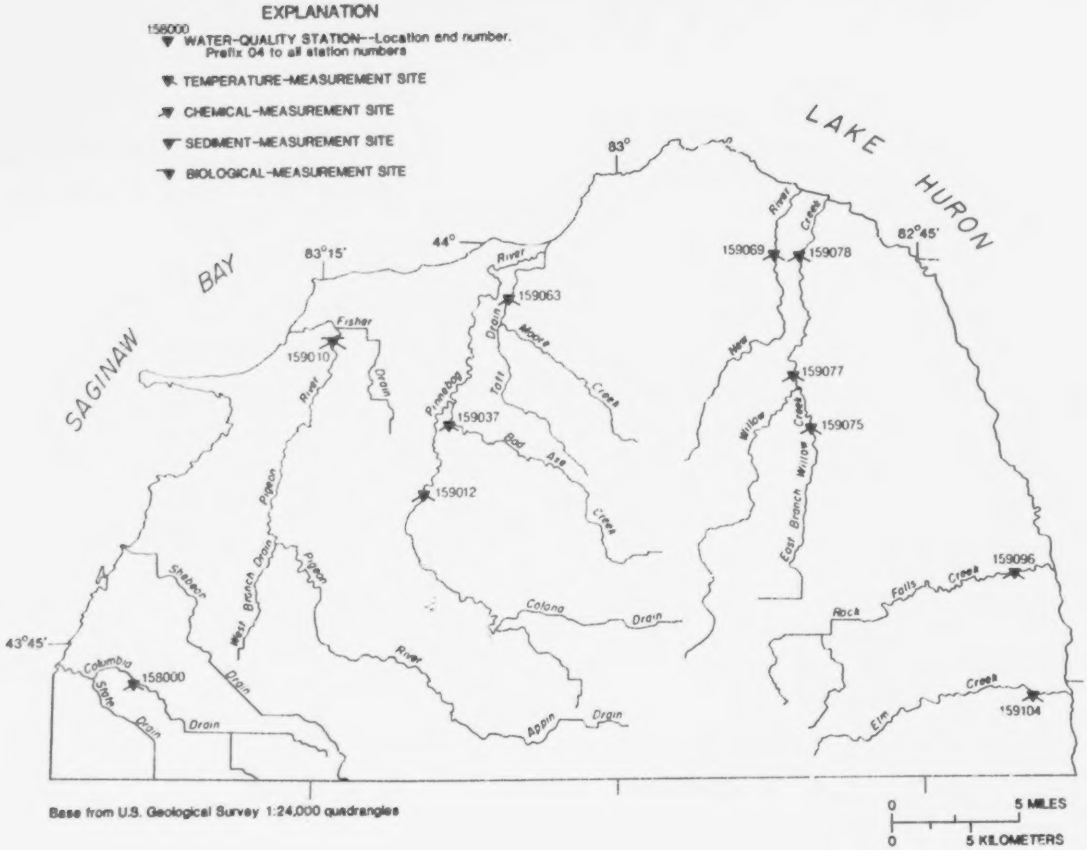
EXPLANATION
158000 WATER-QUALITY STATION--Location and number. Prefix 04 to all station numbers
TEMPERATURE-MEASUREMENT SITE
CHEMICAL-MEASUREMENT SITE
SEDIMENT-MEASUREMENT SITE
BIOLOGICAL-MEASUREMENT SITE
LAKE HURON
SAGINAW BAY
83°
83°15'
82°45'
44°
43°45'
159069
159078
159063
159010
159077
159075
159037
159012
159096
159104
158000
Fisher Drain
River
Pigeon River
Pinnebog River
Taft Drain
Moore Creek
Bad Axe Creek
New River
Willow Creek
East Branch Willow Creek
West Branch Drain
Shebeon Drain
Pigeon River
Colona Drain
Appin Drain
Rock Falls Creek
Elm Creek
Columbia State Drain
Drain
Base from U.S. Geological Survey 1:24,000 quadrangles
0 5 MILES
0 5 KILOMETERS

Figure 9.--Identification number and location of active surface-water-quality stations in Huron County.

04158000 COLUMBIA DRAIN NEAR SEBEWAING, MI

LOCATION.--Lat 43°43'38", long 83°23'46", in SE1/4 SE1/4 sec.10, T.15 N., R.9 E., Huron County, Hydrologic Unit 04080103, on right bank 10 ft downstream from bridge on Gettel Road, 2.5 mi southeast of Sebewaing, and 2.4 mi upstream from mouth.

DRAINAGE AREA.--33.9 mi², revised.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--January 1940 to September 1954, January to September 1988. Monthly discharge only for October to December 1939, published in WSP 1307. Published as East Fork Sebewaing River (Columbia Drain) near Sebewaing 1940-54.

REVISED RECORD.--WSP 1307: 1943, 1947-1948, 1950. WSP 1727: 1952 (M).

GAGE.--Water-stage recorder. Datum of gage is 603.00 ft above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Apr. 1, 1941, nonrecording gage at same site. Prior to Jan. 1, 1988, at datum 5.0 ft higher.

REMARKS.--Estimated daily discharges: Jan. 1 to Mar. 10 and Mar. 17-20. Water-discharge records fair except for estimated daily discharges, which are poor.

AVERAGE DISCHARGE.--15 years (water years 1940-54) 17.2 ft³/s, 6.89 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,720 ft³/s, Mar. 11, 1952, gage height, 11.12 ft; maximum gage height, 14.70 ft, Mar. 15, 1943, backwater from ice (present datum); no flow each year.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of September 1986 exceeded a stage of 18.0 ft (present datum), discharge not determined. Information supplied by local resident.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period of January to September, 498 ft³/s, Mar. 13, gage height, 8.09 ft; maximum gage height, 8.19 ft, Mar. 7, backwater from ice; no flow June 19-22, June 25 to July 30, Aug. 4, 6-16, Aug. 18 to Sept. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1				6.0	60	5.2	52	7.9	.87	.00	1.7	.00
2				5.2	15	5.0	37	7.0	1.5	.00	.67	.00
3				4.6	11	5.0	67	7.0	1.6	.00	.06	.00
4				4.1	9.5	5.2	260	5.9	1.8	.00	.00	.00
5				3.7	8.0	5.5	86	5.7	1.3	.00	[illegible]	80
6				3.4	7.0	6.0	70	4.6	.95	.00	.00	26
7				3.1	6.0	8.0	217	4.3	.60	.00	.00	9.6
8				2.8	5.4	40	68	4.1	.55	.00	.00	5.5
9				2.6	5.0	80	37	4.4	.60	.00	.00	3.3
10				2.4	4.5	90	26	9.4	.67	.00	.00	2.2
11				2.2	4.1	73	20	7.0	.67	.00	.00	1.5
12				2.1	3.9	64	17	7.0	.49	.00	.00	1.1
13				2.1	3.8	231	16	5.3	.19	.00	.00	.89
14				2.1	4.0	77	16	4.4	.16	.00	.00	.59
15				2.2	4.5	33	17	4.4	.10	.00	.00	.56
16				2.3	4.8	23	16	4.8	.03	.00	.00	.42
17				2.5	5.2	20	16	4.6	.01	.00	.16	.32
18				3.5	5.6	18	16	4.4	.02	.00	.00	.28
19				40	6.0	17	14	4.4	.00	.00	.00	.31
20				20	5.8	16	9.2	4.3	.00	.00	.00	.74
21				12	5.4	16	9.2	4.1	.00	.00	.00	.78
22				8.0	5.6	16	8.4	3.9	.00	.00	.00	1.8
23				6.6	6.2	18	18	3.8	.01	.00	.00	1.9
24				5.4	8.0	20	26	2.6	.02	.00	.00	1.7
25				4.8	20	27	18	2.1	.00	.00	.00	2.1
26				4.2	16	40	15	2.1	.00	.00	.00	1.6
27				3.8	8.0	34	13	1.8	.00	.00	.00	1.1
28				3.6	6.0	24	13	1.7	.00	.00	.00	.81
29				3.4	5.6	34	12	1.4	.00	.00	.00	.56
30				3.4	---	99	9.6	1.0	.00	.00	.00	.45
31				15	---	83	---	.73	---	.54	.00	---
TOTAL				187.1	259.9	1232.9	1219.4	136.13	12.14	.54	2.60	146.11
MEAN				6.04	8.96	39.8	40.6	4.39	.40	.017	.084	4.87
MAX				40	60	231	260	9.4	1.8	.54	1.7	80
MIN				2.1	3.8	5.0	8.4	.73	.00	.00	.00	.00
CFSM				.18	.26	1.17	1.20	.13	.01	.001	.002	.14
IN.				.21	.29	1.35	1.34	.15	.01	.00	.00	.16

04158000 COLUMBIA DRAIN NEAR SEBEWAING, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Cross-sectional sample was collected at time of water-discharge measurement, near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3
APR 19...	1600	11	774	8.25	6.5	8.9	13.2	11[illegible]	410	170

DATE	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER WH IT FIELD MG/L AS HCO3	CARBONATE WATER WH IT FIELD MG/L AS CO3	ALKALINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)
APR 19...	110	32	12	6	0.3	2.3	291	0	239	110

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE TOTAL (MG/L AS N)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
APR 19...	47	0.20	0.76	481	0.65	14.3	0.020	0.030	6.40	6.20

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
APR 19...	0.050	0.050	0.70	0.040	0.020	<0.010	<10	<1	34	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
APR 19...	<1	<1	<3	1	9	<5	9	7	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)
APR 19...	1	2	<1.0	270	<6	8

04159010 PIGEON RIVER NEAR CASEVILLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°56'22", long 83°14'30", in SW1/4 NW1/4 sec.31, T.18 N., R.11 E., Huron County, Hydrologic Unit 04080103, on left bank at upstream side of Kinde Road, 1.5 mi east of Caseville, and 3.1 mi upstream from mouth.

DRAINAGE AREA.--125 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1986 to current year.

GAGE.--Water-stage recorder. Datum of gage 578.43 ft above National Geodetic Vertical Datum of 1929. Prior to June 10, 1987, nonrecording gage at same datum.

REMARKS.--Estimated daily discharges: Dec. 20 to Mar. 23, Mar. 30 to Apr. 1, 4, 5, 8, and Sept. 7. Water discharge records fair except for estimated daily discharges, which are poor. Some regulation at low flows.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in September 1986 reached a stage of 18.2 ft, present datum, from floodmarks, discharge 2,900 ft³/s from indirect computation of discharge.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 1,800 ft³/s, Oct. 1, 1986; no flow for several days each year.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 900 ft³/s, Dec. 21; no flow July 5-10, 13-25, Sept. 2, 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	83	57	265	27	180	22	320	51	6.3	.93	35	.05
2	90	42	305	23	120	21	218	44	6.9	.62	103	.00
3	73	36	268	20	80	21	196	45	7.0	.31	53	.00
4	55	37	181	17	60	22	384	38	6.2	.13	17	1.4
5	45	37	117	15	40	24	560	36	5.8	.00	9.0	44
6	39	33	92	14	32	26	410	27	5.2	.00	7.9	134
7	35	26	74	13	26	29	443	24	4.7	.00	5.4	201
8	32	23	61	12	23	125	461	22	4.4	.00	11	105
9	27	23	82	11	21	305	305	21	3.4	.00	11	40
10	25	28	194	10	18	580	186	21	2.8	.00	7.0	22
11	20	30	259	9.5	17	400	134	28	3.7	.03	4.6	15
12	18	26	204	9.0	16	280	105	29	4.5	.08	3.1	12
13	17	24	169	8.8	16	400	87	22	3.1	.00	2.0	11
14	18	22	153	8.8	17	300	77	20	2.2	.00	1.3	11
15	15	19	115	9.0	18	190	72	17	1.8	.00	.76	11
16	7.8	18	97	9.5	19	120	74	15	2.5	.00	.42	10
17	6.7	15	102	11	21	90	68	15	2.5	.00	.26	8.8
18	6.6	15	108	22	23	80	61	18	2.1	.00	.11	7.3
19	6.5	16	107	45	25	70	56	15	1.9	.00	1.3	6.4
20	9.2	18	200	110	24	65	50	14	1.5	.00	1.2	8.0
21	8.7	21	900	50	23	64	42	13	.95	.00	.85	10
22	18	20	720	35	24	62	37	13	1.2	.00	.45	11
23	57	13	350	27	27	70	45	11	.99	.00	.11	14
24	102	13	230	23	29	90	74	10	1.7	.00	.08	14
25	120	14	480	20	38	131	109	8.7	1.6	.00	.11	15
26	124	31	640	18	56	181	92	7.2	2.7	5.5	.36	16
27	114	110	430	16	30	205	76	6.5	2.7	16	1.8	14
28	114	149	250	15	25	173	67	6.9	2.3	24	1.9	11
29	151	134	150	14	23	150	60	6.7	1.7	13	1.4	9.0
30	123	183	70	15	---	280	57	6.5	1.4	7.5	.97	7.5
31	80	---	32	25	---	410	---	6.5	---	5.6	.49	---
TOTAL	1640.5	1233	7405	662.6	1071	4986	4926	618.0	95.74	73.70	282.87	769.45
MEAN	52.9	41.1	239	21.4	36.9	161	164	19.9	3.19	2.38	9.12	25.6
MAX	151	183	900	110	180	580	560	51	7.0	24	103	201
MIN	6.5	13	32	8.8	16	21	37	6.5	.95	.00	.08	.00
CFSM	.42	.33	1.91	.17	.30	1.29	1.31	.16	.03	.02	.07	.21
IN.	.49	.37	2.20	.20	.32	1.48	1.47	.18	.03	.02	.08	.23

CAL YR 1987 TOTAL 26962.42 MEAN 73.9 MAX 1200 MIN .00 CFSM .59 IN 8.02
WTR YR 1988 TOTAL 23763.86 MEAN 64.9 MAX 900 MIN .00 CFSM .52 IN 7.07

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--January 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water year 1980): Maximum daily recorded (more than 20 percent missing record), 2,000 microsiemens, Oct. 20, 1979; minimum daily recorded (more than 20 percent missing record), 175 microsiemens, Mar. 6, 1979.
WATER TEMPERATURE (water year 1978): Maximum daily recorded (more than 20 percent missing record), 27.5°C, July 7, 1978; minimun daily recorded (more than 20 percent missing record), 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
19...	1400	6.7	875	8.08	11.0	17	7.4	68	K79	K110
MAR										
09...	1400	305	--	7.68	1.0	14	11.8	86	300	K15000
APR										
19...	1300	58	762	8.26	6.0	2.1	14.2	118	75	K44
JUL										
13...	1530	0.03	757	8.64	20.0	1.1	--	--	K60	420

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
19...	470	200	130	34	19	8	0.4	4.4	319	0
MAR										
09...	130	22	36	8.5	5.3	8	0.2	6.1	125	0
APR										
19...	410	150	110	32	13	6	0.3	3.2	317	0
JUL										
13...	350	160	82	36	27	14	0.6	3.5	228	1

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
OCT										
19...	262	150	48	0.30	2.4	561	0.76	10.1	--	<0.010
MAR										
09...	103	25	13	0.10	5.9	178	0.24	147	--	0.050
APR										
19...	260	100	41	0.20	0.94	498	0.68	78.0	0.030	--
JUL										
13...	189	150	53	0.20	10	496	0.67	0.04	<0.010	<0.010

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)
OCT 19...	--	2.40	0.040	0.050	1.0	0.020	<0.010	<0.010	<10	1
MAR 09...	--	1.80	1.10	1.10	3.6	0.420	0.310	0.240	80	<1
APR 19...	6.60	--	0.030	--	--	--	0.020	--	<10	1
JUL 13...	<0.100	0.230	0.030	0.050	0.80	0.410	0.400	0.320	<10	8

DATE	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)
OCT 19...	57	<0.5	<1	1	<3	6	52	6	7	32
MAR 09...	25	<0.5	<1	<1	<3	7	140	<5	6	60
APR 19...	41	<0.5	<1	<1	<3	1	15	<5	6	22
JUL 13...	17	<0.5	<1	<1	<3	<1	13	<5	16	440

DATE	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)
OCT 19...	<0.1	<10	<1	2	1.0	360	<6	20	38	0.69
MAR 09...	<0.1	<10	8	<1	2.0	170	<6	4	37	30
APR 19...	<0.1	<10	2	1	<1.0	270	<6	3	126	20
JUL 13...	0.9	<10	<1	<1	<1.0	490	<6	9	4	0.00

DATE	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 19...	83
MAR 09...	75
APR 19...	74
JUL 13...	76

04159C12 PINNEBOG RIVER NEAR ELKTON, MI

LOCATION.--Lat 43°50'53", long 83°09'44", in NE1/4 NE1/4 sec.3, T.16 N., R.11 E., Huron County, Hydrologic Unit 04080103, at bridge on Berne Road, 2.3 mi northeast of Elkton.

DRAINAGE AREA.--73.3 mi^2.

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
APR										
21...	1000	35	854	8.40	5.0	12.9	104	352	4	295
JUL										
14...	1415	0.01	1910	8.80	29.0	14.6	197	51	7	54

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
APR										
21...	0.020	0.020	3.90	3.80	0.140	0.120	1.2	0.460	0.400	0.330
JUL										
14...	--	--	--	--	--	--	--	--	--	--

04159037 BAD AXE CREEK NEAR ELKTON, MI

LOCATION.--Lat 43°53'28", long 83°08'28", in NW1/4 NW1/4 sec.24, T.17 N., R.11 E., Huron County, Hydrologic Unit 04080103, at bridge on Filion Road, 5.5 mi northeast of Elkton.

DRAINAGE AREA.--28.3 mi^2.

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurement was made at time of sampling. Cross-sectional sample was collected near bridge. No flow was observed July 13.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
APR 21...	1000	13	786	7.95	3.5	14.2	110	328	0	269

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
APR 21...	0.060	0.060	5.60	5.40	0.160	0.170	1.0	0.100	0.080	0.050

04159063 TAFT DRAIN NEAR PINNEBOG, MI

LOCATION.--Lat 43°57'52", long 83°05'53", in SE1/4 SW1/4 sec.20, T.18 N., R.12 E., Huron County, Hydrologic Unit 04080103, at bridge on Oak Beach Road, 2.0 mi northeast of Pinnebog.

DRAINAGE AREA.--31.1 mi².

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurements were made at times of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3
APR										
19...	1300	11	671	8.25	5.0	1.4	15.0	121	360	92
JUL										
14...	1530	0.43	525	8.19	31.5	1.4	8.6	120	270	40

DATE	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER WH IT FIELD MG/L AS HCO3	CARBONATE WATER WH IT FIELD MG/L AS CO3	ALKALINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)
APR										
19...	99	27	9.1	5	0.2	2.7	324	0	266	60
JUL										
14...	60	29	18	12	0.5	5.1	279	0	229	32

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE TOTAL (MG/L AS N)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
APR										
19...	30	0.20	0.77	417	0.57	12.4	0.020	0.030	5.20	5.20
JUL										
14...	32	0.40	9.1	330	0.45	0.38	<0.010	<0.010	<0.100	<0.100

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
APR										
19...	0.030	0.030	0.50	0.020	0.020	<0.010	<10	1	31	<0.5
JUL										
14...	<0.010	0.020	1.1	0.070	0.020	<0.010	<10	7	41	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
APR										
19...	<1	<1	<3	1	15	<5	6	29	0.2	<10
JUL										
14...	<1	<1	<3	<1	19	<5	14	150	<0.1	<10

04159063 TAFT DRAIN NEAR PINNEBOG, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)
APR						
19...	2	<1	<1.0	190	<6	<3
JUL						
14...	<1	<1	<1.0	410	<6	<3

04159069 NEW RIVER NEAR HURON CITY, MI

LOCATION.--Lat 44°00'05", long 82°52'25", in SW1/4 SE1/4 sec.7, T.18 N., R.14 E., Huron County, Hydrologic Unit 04080104, at bridge on Stoddard Road, 2.8 mi southwest of Huron City.

DRAINAGE AREA.--22.1 mi².

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurement was made at time of sampling. Cross-sectional sample was collected near bridge. No flow was observed July 14.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
APR										
20...	1030	5.3	706	8.21	5.5	12.6	104	299	0	245

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
APR									
20...	0.020	0.020	3.80	3.80	0.060	0.50	0.040	0.030	0.010

04159075 EAST BRANCH WILLOW CREEK NEAR REDMAN, MI

LOCATION.--Lat 43°53'59", long 82°50'22", in SW1/4 SW1/4 sec.16, T.17 N., R.14 E., Huron County, Hydrologic Unit 04080104, at bridge on Filion Road, 2.1 mi south of Redman.

DRAINAGE AREA.--32.0 mi^2.

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurement was made at time of sampling. Cross-sectional sample was collected near bridge. No flow was observed July 14.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
APR										
20...	1430	9.2	842	8.26	6.0	13.1	110	322	0	264

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
APR										
20...	0.020	0.020	3.90	3.90	0.060	0.050	0.80	0.040	0.040	0.020

04159077 WILLOW CREEK NEAR REDMAN, MI

LOCATION.--Lat 43°54'49", long 82°51'13", in NW1/4 NE1/4 sec.8, T.17 N., R.14 E., Huron County, Hydrologic Unit 04080104, at bridge on Redman Road, 1.0 mi west of Redman.

DRAINAGE AREA.--69.8 mi².

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurement was made at time of sampling. Cross-sectional sample was collected near bridge. No flow was observed July 14.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	BICARBONATE WATER WH IT FIELD MG/L AS HCO3	CARBONATE WATER WH IT FIELD MG/L AS CO3	ALKALINITY WAT WH TOT IT FIELD MG/L AS CACO3
APR										
20...	1400	26	593	8.15	6.0	12.1	101	316	0	259

DATE	NITROGEN, NITRITE TOTAL (MG/L AS N)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)
APR										
20...	0.020	0.020	2.80	2.80	0.100	0.100	0.90	0.050	0.030	0.010

04159078 WILLOW CREEK NEAR HURON CITY, MI

LOCATION.--Lat 44°00'02", long 82°51'15", in NW1/4 NE1/4 sec.17, T.18 N., R.14 E., Huron County, Hydrologic Unit 04080104, at bridge on Stoddard Road, 2.3 mi southwest of Huron City.

DRAINAGE AREA.--74.4 mi².

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3
APR 20...	1130	29	654	8.20	6.5	2.7	13.2	112	350	110
JUL 14...	1020	0.01	623	8.52	24.0	1.3	6.0	74	280	72

DATE	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)
APR 20...	100	25	11	6	0.3	3.0	294	0	241	77
JUL 14...	55	35	26	17	0.7	3.0	242	7	210	54

DATE	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
APR 20...	32	0.20	0.58	425	0.58	33.3	0.030	0.030	3.00	3.00
JUL 14...	51	0.30	7.3	406	0.55	0.01	<0.010	<0.010	<0.100	<0.100

DATE	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)
APR 20...	0.070	0.070	1.0	0.040	0.020	<0.010	<10	1	47	<0.5
JUL 14...	0.020	0.020	1.2	0.060	0.040	<0.010	<10	10	62	<0.5

DATE	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)
APR 20...	<1	2	<3	1	18	<5	7	24	<0.1	<10
JUL 14...	<1	<1	<3	1	51	<5	8	24	0.1	<10

04159078 WILLOW CREEK NEAR HURON CITY, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)
APR						
20...	1	<1	<1.0	220	<6	<3
JUL						
14...	<1	<1	<1.0	280	<6	6

04159096 ROCK FALLS CREEK NEAR HARBOR BEACH, MI

LOCATION.--Lat 43°48'40", long 82°39'45", in NW1/4 SW1/4 sec.24, T.16 N., R.15 E., Huron County, Hydrologic Unit 04080104, at bridge on Schock Road, 2.4 mi southwest of Harbor Beach.

DRAINAGE AREA.--30.4 mi².

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
APR										
20...	1200	10	774	8.37	6.0	13.2	110	332	1	274
JUL										
14...	1300	0.26	608	8.18	25.5	10.0	126	255	0	209

DATE	NITRO-GEN, NITRITE TOTAL (MG/L AS N)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)
APR										
20...	0.010	0.010	4.20	4.10	0.070	0.040	1.0	0.040	0.040	<0.010
JUL										
14...	<0.010	<0.010	<0.100	<0.100	<0.010	0.010	0.60	0.030	0.010	<0.010

04159104 ELM CREEK NEAR WHITE ROCK, MI

LOCATION.--Lat 43°44'24", long 82°38'33", in SE1/4 NE1/4 sec.13, T.15 N., R.15 E., Huron County, Hydrologic Unit 04080104, at bridge on Edwards Road, 2.8 mi northwest of White Rock.

DRAINAGE AREA.--24.4 mi^2.

PERIOD OF RECORD.--April to July 1988.

REMARKS.--Water-discharge measurements were made at time of sampling. Cross-sectional samples were collected near bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAMFLOW, INSTANTANEOUS (CFS)	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB WH WAT TOT FLD MG/L AS CACO3
APR										
20...	1015	6.4	872	7.93	5.5	2.9	12.9	106	410	130
JUL										
14...	1000	0.44	570	7.92	22.0	0.50	7.4	87	300	26

DATE	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER WH IT FIELD MG/L AS HCO3	CARBONATE WATER WH IT FIELD MG/L AS CO3	ALKALINITY WAT WH TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)
APR										
20...	110	33	18	9	0.4	3.4	339	0	278	90
JUL										
14...	78	26	25	15	0.6	2.5	337	0	276	61

DATE	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE TOTAL (MG/L AS N)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
APR										
20...	44	0.20	1.7	496	0.67	8.57	0.020	0.020	4.20	4.20
JUL										
14...	37	0.30	8.7	385	0.52	0.46	<0.010	<0.010	<0.100	<0.100

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
APR										
20...	0.040	0.040	0.60	0.030	0.020	<0.010	<10	2	48	<0.5
JUL										
14...	0.050	0.030	0.50	0.020	0.020	<0.010	<10	4	110	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
APR										
20...	<1	<1	<3	1	24	<5	11	44	<0.1	<10
JUL										
14...	<1	<1	<3	1	8	<5	15	49	<0.1	<10

04159104 ELM CREEK NEAR WHITE ROCK, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NICKEL, DIS- SOLVED (UG/L AS NI)	SELE- NIUM, DIS- SOLVED (UG/L AS SE)	SILVER, DIS- SOLVED (UG/L AS AG)	STRON- TIUM, DIS- SOLVED (UG/L AS SR)	VANA- DIUM, DIS- SOLVED (UG/L AS V)	ZINC, DIS- SOLVED (UG/L AS ZN)
APR						
20...	3	<1	<1.0	320	<6	8
JUL						
14...	<1	<1	<1.0	290	<6	6

04159130 ST. CLAIR RIVER AT PORT HURON, MI
(National stream quality accounting network station)

LOCATION.--Lat 42°59'19", long 82°25'29", in SE1/4 sec.3, T.6 N., R.17 E., St. Clair County, Hydrologic Unit 04090001, at Port Huron municipal water-treatment plant in Port Huron.

DRAINAGE AREA.--222,400 mi², approximately.

PERIOD OF RECORD.--Water years 1970-73, 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Bimonthly samples were collected near the Port Huron municipal water-treatment plant. Daily-mean water discharge is reported at sample time.

COOPERATION.--Water discharges were provided by the National Oceanic and Atmospheric Administration.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-81): Maximum daily, 260 microsiemens, Dec. 18, 1980; minimum daily, 194 microsiemens, Jan. 27, 28, 1980.
WATER TEMPERATURE (water years 1979-81): Maximum daily, 24.0°C, Aug. 14-16, 1980; minimum daily, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 164 microsiemens was measured July 3, 1972.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
23...	1130	191000	206	7.8	6.5	0.30	11.6	97	K3	K1
DEC										
08...	1300	191000	213	8.2	6.0	0.40	11.8	96	K2	K4
MAR										
28...	1230	198000	--	8.1	2.0	0.60	14.1	103	<1	K2
MAY										
20...	1130	205000	221	8.2	10.0	0.60	11.8	107	<1	K1
JUN										
08...	0930	208000	218	8.2	16.0	13	10.8	112	K2	K4
SEP										
15...	0945	200000	218	8.3	18.0	6.2	9.0	96	K10	K5

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
23...	100	--	28	7.4	3.6	7	0.2	0.90	--	--
DEC										
08...	98	22	27	7.4	3.4	7	0.2	1.0	93	0
MAR										
28...	100	16	28	7.7	3.6	7	0.2	0.90	105	0
MAY										
20...	110	24	30	8.1	4.3	8	0.2	1.0	103	0
JUN										
08...	100	20	28	7.7	3.9	8	0.2	0.90	100	0
SEP										
15...	100	22	28	7.8	3.6	7	0.2	0.90	98	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV									
23...	--	18	6.2	0.10	1.2	118	0.16	60900	<0.010
DEC									
08...	76	18	10	0.20	1.2	114	0.16	58800	<0.010
MAR									
28...	86	18	6.1	0.20	1.2	117	0.16	62500	<0.010
MAY									
20...	84	20	7.3	0.20	0.72	117	0.16	64800	<0.010
JUN									
08...	82	20	5.8	0.30	1.0	113	0.15	63500	<0.010
SEP									
15...	80	17	6.1	0.10	1.0	119	0.16	64300	<0.010

04159130 ST. CLAIR RIVER AT PORT HURON, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHOROUS TOTAL (MG/L AS P)	PHOSPHOROUS DISSOLVED (MG/L AS P)	PHOSPHOROUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)
NOV 23...	0.220	0.010	0.010	0.30	<0.010	<0.010	<0.010	<10	1
DEC 08...	0.270	<0.010	<0.010	0.20	0.010	<0.010	<0.010	--	--
MAR 28...	0.290	<0.010	<0.010	0.30	<0.010	<0.010	<0.010	<10	<1
MAY 20...	0.350	<0.010	<0.010	<0.20	0.010	<0.010	<0.010	<10	1
JUN 08...	0.270	0.020	0.010	0.20	0.010	<0.010	<0.010	--	--
SEP 15...	0.220	<0.010	<0.010	<0.20	0.020	<0.010	<0.010	<10	<1

DATE	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)
NOV 23...	20	<0.5	<1	<1	<3	1	<3	<5	<4
DEC 08...	--	--	--	--	--	--	--	--	--
MAR 28...	15	<0.5	<1	<1	<3	1	<3	<5	5
MAY 20...	25	<0.5	<1	<1	<3	1	9	<5	4
JUN 08...	--	--	--	--	--	--	--	--	--
SEP 15...	14	<0.5	<1	<1	<3	1	<3	<5	<4

DATE	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)
NOV 23...	<1	<0.1	<10	2	<1	1.0	96	<6	5
DEC 08...	--	--	--	--	--	--	--	--	--
MAR 28...	<1	<0.1	<10	3	<1	<1.0	98	<6	<3
MAY 20...	<1	<0.1	<10	<1	<1	<1.0	100	<6	18
JUN 08...	--	--	--	--	--	--	--	--	--
SEP 15...	<1	<0.1	<10	5	<1	<1.0	97	<6	<3

04159500 BLACK RIVER NEAR FARGO, MI

LOCATION.--Lat 43°05'32", long 82°37'05", in NW1/4 sec.32, T.8 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, on left bank 20 ft downstream from bridge on Norman Road, 2.1 mi east of Fargo, 5.3 mi upstream from Mill Creek, and 12 mi northwest of Port Huron.

DRAINAGE AREA.--480 mi^2.

PERIOD OF RECORD.--February 1944 to current year.

REVISED RECORDS.--WSP 1307: 1950(M). WSP 1627: 1956-58. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 613.75 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 9, 1954, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 30 to Mar. 17. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 299 ft^3/s, 8.46 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,400 ft^3/s, Apr. 5, 1947, gage height, 16.06 ft, from floodmark, from rating curve extended above 9,500 ft^3/s; maximum gage height observed, 18.05 ft, Feb. 20, 1951, backwater from ice; minimum discharge observed, 1.8 ft^3/s, Sept. 18, 19, 1946.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 21	1000	*4,160	10.47	Mar. 9	--	3,900	*a12.38

a Ice jam.

Minimum discharge, 7.8 ft^3/s, July 1, gage height, 1.64 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	27	126	904	100	500	120	391	160	39	9.5	21	12
2	25	101	903	85	350	130	324	141	38	15	20	12
3	26	89	622	75	250	140	311	129	37	15	24	12
4	27	86	441	66	180	160	571	128	36	16	25	14
5	27	82	376	60	150	200	1140	113	37	16	30	16
6	25	80	305	54	120	250	628	101	35	15	35	113
7	24	73	245	50	100	300	499	97	32	15	41	94
8	23	68	221	46	90	900	610	89	31	14	34	58
9	23	68	532	43	85	3500	439	85	30	14	21	39
10	22	82	1160	41	81	2000	323	89	27	14	23	29
11	24	90	795	39	76	1200	262	90	28	14	25	23
12	23	84	577	38	74	1000	220	90	28	13	18	20
13	21	79	630	37	72	1600	193	87	27	13	22	19
14	21	76	491	36	72	1100	181	84	26	13	20	15
15	21	71	472	36	76	560	186	78	26	13	15	12
16	21	62	1370	36	85	400	198	77	25	13	13	12
17	21	58	1490	36	95	330	186	91	23	20	13	12
18	23	73	851	150	110	324	182	98	22	20	13	12
19	23	106	576	450	130	374	189	85	21	18	14	13
20	24	112	1430	400	150	360	188	76	21	16	14	16
21	35	93	3990	300	140	289	172	71	20	18	16	15
22	60	69	3060	180	135	244	168	67	20	13	13	14
23	129	70	1230	120	130	240	352	63	21	17	12	19
24	176	66	708	95	160	392	897	58	20	16	13	22
25	202	298	715	80	210	569	553	56	19	15	14	21
26	229	2290	935	70	190	827	340	57	19	18	13	22
27	212	1780	654	65	170	818	254	51	17	17	13	21
28	451	770	426	60	140	531	215	49	17	25	14	19
29	381	542	330	55	130	393	196	47	17	29	13	15
30	246	884	190	60	---	430	181	44	14	24	12	15
31	172	---	130	150	---	468	---	41	---	22	12	---
TOTAL	2764	8528	26759	3113	4251	20149	10549	2592	773	515.5	586	736
MEAN	89.2	284	863	100	147	650	352	83.6	25.8	16.6	18.9	24.5
MAX	451	2290	3990	450	500	3500	1140	160	39	29	41	113
MIN	21	58	130	36	72	120	168	41	14	9.5	12	12
CFSM	.19	.59	1.80	.21	.31	1.35	.73	.17	.05	.04	.04	.05
IN.	.21	.66	2.07	.24	.33	1.56	.82	.20	.06	.04	.05	.06

CAL YR 1987 TOTAL 101769.0 MEAN 279 MAX 3990 MIN 16 CFSM .58 IN 7.89
WTR YR 1988 TOTAL 81315.5 MEAN 222 MAX 3990 MIN 9.5 CFSM .46 IN 6.30

04159900 MILL CREEK NEAR AVOCA, MI

LOCATION.--Lat 43°03'16", long 82°44'05", in NW1/4 sec.8, T.7 N., R.15 E., St. Clair County, Hydrologic Unit 04090001, on left bank at downstream side of bridge on Bricker Road, 0.2 mi upstream from Gleason Drain, and 2.3 mi west of Avoca.

DRAINAGE AREA.--169 mi^2.

PERIOD OF RECORD.--April 1963 to September 1975, October 1975 to September 1979 (operated as a crest-stage partial-record station), October 1987 to September 1988. Also operated as a low-flow partial-record station in water year 1979.

GAGE.--Water-stage recorder. Datum of gage is 711.31 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Oct. 1-6, Nov. 23 to Mar. 13, Mar. 15, and Sept. 30. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--13 years (water years 1964-75, 1988), 94.8 ft^3/s, 7.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,570 ft^3/s, Apr. 19, 1975, gage height, 8.87 ft; minimum, 0.8 ft^3/s, Aug. 9, 10, 11, 1964; minimum gage height, 0.56 ft, July 28, 1965.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 21	unknown	*1,070	unknown	Mar. 9	--	980	*a6.27

a Ice jam.

Minimum daily discharge, 1.4 ft^3/s, Aug. 19; minimum gage height, 0.71 ft, July 10-13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.6	37	260	40	130	60	130	69	9.5	6.4	5.8	3.1
2	8.4	30	210	35	170	65	113	61	11	5.9	6.1	1.7
3	8.0	30	170	30	100	75	123	55	9.6	5.7	11	3.0
4	8.4	29	140	26	60	85	217	49	8.5	5.3	13	3.3
5	8.6	26	120	24	50	100	255	44	8.7	5.1	11	4.6
6	8.2	28	100	22	45	170	201	43	9.0	4.6	14	3.9
7	9.3	21	90	21	41	300	231	42	7.8	4.2	14	3.6
8	9.4	19	150	20	39	600	294	44	6.5	3.9	12	4.0
9	10	19	230	19	38	900	224	47	7.9	3.6	10	5.8
10	13	24	340	18	38	820	174	53	7.7	3.2	16	6.5
11	15	25	250	18	37	480	143	52	6.9	2.7	13	5.8
12	16	25	220	18	35	440	121	51	6.2	2.7	11	5.6
13	15	25	200	17	34	680	102	49	5.5	3.0	9.4	5.6
14	15	26	150	17	37	542	91	46	4.8	3.9	7.5	4.9
15	15	22	240	17	42	360	81	41	4.2	5.1	6.9	4.1
16	17	18	570	17	47	260	73	40	4.0	6.6	4.4	3.3
17	19	15	430	30	55	199	66	47	4.4	12	3.1	3.8
18	20	19	320	60	62	174	68	42	5.4	15	1.6	4.3
19	19	20	250	140	68	172	68	34	5.7	28	1.4	3.2
20	23	24	500	130	62	156	66	29	6.0	24	3.2	4.4
21	29	23	980	120	61	134	66	27	5.8	15	2.5	3.5
22	41	21	620	100	60	112	64	26	5.5	11	2.2	3.9
23	34	30	400	85	130	105	138	22	5.7	9.0	2.4	6.6
24	36	30	280	70	280	155	254	20	6.2	8.0	4.8	8.9
25	41	90	260	55	230	202	187	18	7.0	5.4	10	8.1
26	42	500	250	43	140	255	139	16	4.9	4.8	8.6	8.1
27	55	370	180	33	90	249	102	16	5.2	4.1	6.5	7.9
28	55	250	120	26	80	191	86	14	5.9	6.2	6.1	11
29	62	280	90	29	70	157	80	12	6.4	13	6.4	11
30	53	320	65	32	---	153	75	10	6.2	10	5.8	10
31	44	---	50	60	---	148	---	9.8	---	7.8	4.7	---
TOTAL	757.9	2396	8235	1372	2331	8499	4032	1128.8	198.1	245.2	234.4	163.5
MEAN	24.4	79.9	266	44.3	80.4	274	134	36.4	6.60	7.91	7.56	5.45
MAX	62	500	980	140	280	900	294	69	11	28	16	11
MIN	8.0	15	50	17	34	60	64	9.8	4.0	2.7	1.4	1.7
CFSM	.14	.47	1.57	.26	.48	1.62	.79	.22	.04	.05	.05	.03
IN.	.17	.53	1.81	.30	.51	1.87	.89	.25	.04	.05	.05	.04

WTR YR 1988 TOTAL 29592.9 MEAN 80.9 MAX 980 MIN 1.4 CFSM .48 IN 6.51

04160570 NORTH BRANCH BELLE RIVER AT IMLAY CITY, MI

LOCATION.--Lat 43°01'49", long 83°04'02", in SW1/4 NW1/4 sec.16, T.7 N., R.12 E., Lapeer County, Hydrologic Unit 04090001, on left bank 12 ft upstream from bridge on State Highway 21, 0.6 mi northeast of Imlay City.

DRAINAGE AREA.--18.0 mi².

PERIOD OF RECORD.--August 1965 to current year.

GAGE.--Water-stage recorder. Concrete control Aug. 20, 1965, to Nov. 2, 1981. Datum of gage is 789.69 ft above National Geodetic Vertical Datum of 1929 (levels by Boldt, McLeod, and Johnson, Inc.). Prior to Feb. 24, 1985, at datum 2.00 ft higher.

REMARKS.--Estimated daily discharges: Dec. 29 to Mar. 8, May 26, 27, and Aug. 1-12. Records good except for period of estimated daily discharges, Dec. 29 to Mar. 8, which is fair and those for the summer months, which are poor. Some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 12.1 ft³/s, 9.13 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 354 ft³/s, June 12, 1986, gage height, 6.66 ft, from rating curve extended above 100 ft³/s; maximum gage height, 9.33 ft, Apr. 19, 1975, datum then in use; no flow part of each day June 27, 28, 1977, June 26-28, 1979, June 30, 1988, caused by irrigation pumpage.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 60 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 25	1900	62	3.26	Mar. 8	2300	85	3.63
Dec. 20	1900	*93	*3.77	Mar. 12	2400	68	3.39

No flow for part of June 30, caused by irrigation pumpage.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.0	8.4	25	7.0	23	11	19	6.2	.62	1.3	2.1	.77
2	5.1	9.2	24	6.0	17	12	19	11	1.8	1.3	1.7	.83
3	4.6	7.7	21	5.4	14	13	26	10	1.7	1.1	1.6	1.0
4	3.5	7.2	19	4.8	12	12	40	5.5	1.4	.97	1.2	.89
5	3.2	5.9	17	4.4	10	11	33	4.4	1.3	1.0	3.2	1.5
6	3.7	5.1	14	4.1	8.5	15	32	4.0	2.1	1.2	4.3	1.2
7	3.5	4.8	12	3.9	8.0	30	46	4.1	2.8	1.1	3.7	1.2
8	3.1	5.0	15	3.7	7.5	50	34	6.6	2.3	1.0	3.1	3.3
9	2.8	6.0	28	3.5	7.0	68	26	12	2.0	1.2	2.6	1.5
10	2.6	5.6	28	3.4	6.8	45	21	10	1.5	1.1	2.2	1.0
11	2.8	4.8	22	3.3	6.6	41	16	8.2	1.2	.92	1.8	.53
12	2.8	5.1	23	3.2	6.4	48	11	5.7	1.1	1.1	1.5	.95
13	2.8	5.3	22	3.2	6.4	54	9.0	5.0	1.2	1.1	1.4	5.2
14	2.9	4.3	19	3.2	6.6	37	10	4.3	1.0	1.2	1.4	9.6
15	3.0	4.7	32	3.2	7.0	32	10	4.0	.77	1.2	1.2	2.3
16	3.1	4.2	48	3.2	8.5	25	9.3	7.2	.67	3.0	1.2	1.4
17	3.9	5.8	39	9.0	10	22	8.5	5.8	.94	9.5	1.0	.85
18	4.3	9.9	33	20	11	22	9.3	4.7	.95	4.3	1.0	.68
19	3.8	7.3	29	17	12	21	8.0	4.1	.89	3.2	.89	.89
20	5.8	6.0	68	15	11	21	6.9	3.9	.83	1.4	.72	4.5
21	6.7	5.9	68	12	10	18	8.5	3.5	.89	1.5	.62	3.7
22	6.0	4.8	46	10	10	15	7.5	3.0	.94	1.5	.49	2.8
23	9.2	5.1	39	8.0	25	17	28	2.7	1.0	1.3	.95	3.5
24	10	5.8	35	7.0	35	25	24	2.3	1.0	1.2	1.2	2.3
25	11	40	36	6.5	25	27	23	1.8	1.1	1.4	1.3	1.6
26	7.9	46	31	5.6	17	31	19	1.7	1.0	1.8	1.2	1.4
27	17	34	25	5.0	13	26	14	1.6	.91	1.7	1.0	1.4
28	13	26	22	4.6	12	21	11	1.4	1.0	1.5	.83	1.1
29	9.5	28	15	5.0	11	20	7.1	1.7	.89	1.4	.62	1.6
30	7.4	27	10	5.6	---	24	6.2	1.9	.53	1.6	.83	1.3
31	5.6	---	8.5	8.0	---	22	---	.89	---	2.8	.77	---
TOTAL	176.6	344.9	873.5	203.8	357.3	836	542.3	149.19	36.33	55.89	47.62	60.79
MEAN	5.70	11.5	28.2	6.57	12.3	27.0	18.1	4.81	1.21	1.80	1.54	2.03
MAX	17	46	68	20	35	68	46	12	2.8	9.5	4.3	9.6
MIN	2.6	4.2	8.5	3.2	6.4	11	6.2	.89	.53	.92	.49	.53
CFSM	.32	.64	1.57	.37	.68	1.50	1.01	.27	.07	.10	.09	.11
IN.	.36	.71	1.81	.42	.74	1.73	1.12	.31	.08	.12	.10	.13

CAL YR 1987 TOTAL 4150.66 MEAN 11.4 MAX 70 MIN .97 CFSM .63 IN 8.58
WTR YR 1988 TOTAL 3684.22 MEAN 10.1 MAX 68 MIN .49 CFSM .56 IN 7.61

04160600 BELLE RIVER AT MEMPHIS, MI

LOCATION.--Lat 42°54'03", long 82°46'09", in NW1/4 SE1/4 sec.35, T.6 N., R.14 E., St. Clair County, Hydrologic Unit 04090001, on right downstream side of bridge on State Highway 19 at Memphis.

DRAINAGE AREA.--151 mi^2.

PERIOD OF RECORD.--October 1962 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 705.41 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Transportation benchmark).

REMARKS.--Estimated daily discharges: Dec. 30 to Feb. 22 and July 4-27. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 91.8 ft^3/s, 8.26 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,520 ft^3/s, Apr. 19, 1975, gage height, 8.96 ft; minimum, 2.3 ft^3/s, Sept. 6, 10, 1978; minimum gage height, 1.17 ft, Sept. 6, 1978.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1947, reached a stage of about 9 ft, from information by local residents.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 600 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 21	1100	*962	*5.75	Mar. 13	1700	605	4.60
Mar. 9	1700	914	5.61				

Minimum daily discharge, 3.5 ft^3/s, July 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988 MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	18	33	229	45	100	84	101	45	16	6.3	16	7.2
2	19	33	213	40	150	92	89	42	16	5.7	15	7.0
3	19	38	155	35	90	130	98	43	15	5.8	16	7.6
4	18	38	127	30	75	130	222	43	18	5.5	16	9.2
5	17	36	112	28	65	119	224	41	18	5.2	16	11
6	17	32	92	26	55	153	163	42	16	5.0	16	11
7	18	29	77	25	50	292	220	48	15	4.8	23	11
8	17	26	95	23	47	519	267	50	15	4.7	21	10
9	17	26	234	22	44	789	180	52	17	4.5	17	9.5
10	16	27	315	21	43	702	134	59	17	4.3	17	10
11	16	28	213	21	42	392	100	63	16	4.1	16	8.8
12	16	26	197	20	41	383	84	59	15	4.0	16	8.6
13	16	26	184	20	40	549	70	58	14	3.9	14	8.4
14	16	25	134	20	41	416	64	55	13	3.7	12	8.1
15	16	24	242	20	45	256	66	55	13	3.5	10	13
16	16	23	511	20	55	184	63	56	12	9.0	9.7	13
17	18	24	463	35	64	143	59	52	9.8	17	9.7	9.8
18	16	27	302	80	72	143	61	44	9.1	13	9.3	9.0
19	20	32	223	125	80	171	59	38	8.4	11	8.8	8.9
20	20	32	539	120	75	141	55	36	9.5	10	8.5	10
21	19	29	874	110	72	112	53	31	9.2	9.5	8.2	11
22	24	24	568	80	70	100	54	27	8.0	9.0	7.6	15
23	26	26	333	60	168	96	61	25	6.5	10	8.4	16
24	27	26	251	45	250	147	117	23	8.9	12	8.9	15
25	31	233	233	40	236	193	94	21	7.1	18	12	16
26	36	441	216	36	166	227	73	20	6.5	23	10	13
27	59	364	168	33	115	211	61	19	8.3	20	10	12
28	69	211	125	30	90	158	54	18	8.2	17	9.2	9.9
29	58	267	104	32	76	122	51	16	7.6	14	8.6	9.3
30	44	281	70	34	---	119	48	16	7.5	12	8.2	9.2
31	37	---	55	45	---	118	---	16	---	11	7.5	---
TOTAL	776	2487	7654	1321	2517	7391	3045	1213	360.6	286.5	385.6	317.5
MEAN	25.0	82.9	247	42.6	86.8	238	102	39.1	12.0	9.24	12.4	10.6
MAX	69	441	874	125	250	789	267	63	18	23	23	16
MIN	16	23	55	20	40	84	48	16	6.5	3.5	7.5	7.0
CFSM	.17	.55	1.64	.28	.58	1.58	.68	.26	.08	.06	.08	.07
IN.	.19	.61	1.89	.33	.62	1.82	.75	.30	.09	.07	.09	.08

CAL YR 1987 TOTAL 30189.0 MEAN 82.7 MAX 1010 MIN 10 CFSM .55 IN 7.44
WTR YR 1988 TOTAL 27754.2 MEAN 75.8 MAX 874 MIN 3.5 CFSM .50 IN 6.84

04160800 SASHABAW CREEK NEAR DRAYTON PLAINS, MI

LOCATION.--Lat 42°43'12", long 83°21'13", in SE1/4 sec.26, T.4 N., R.9 E., Oakland County, Hydrologic Unit 04090003, on right bank at upstream side of culverts on Maybee Road, 1.1 mi upstream from mouth, and 2.5 mi northeast of Drayton Plains.

DRAINAGE AREA.--20.9 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Metal V-notch weir Aug. 30, 1961, to Mar. 6, 1968. Elevation of gage is 970 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 29 to Feb. 26, Feb. 28, Mar. 4, 5, and July 17 to Aug. 25. Records good except for period of estimated daily discharges, Dec. 29 to Feb. 26, which is fair and period of estimated daily discharges July 17 to Aug. 25, which is poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 12.7 ft³/s, 8.25 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 181 ft³/s, Oct. 1, 1981, gage height, 4.53 ft; minimum, 0.03 ft³/s, July 9, 16, 1988; minimum gage height, 1.59 ft, Aug. 1, 2, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 55 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 20	2200	*57	*3.29	No other peak greater than base discharge.			

Minimum discharge, 0.03 ft³/s, July 9, 16, gage height, 1.63 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.1	8.4	23	19	26	12	25	13	2.1	.18	2.1	.66
2	3.7	8.6	23	17	17	12	24	12	3.1	.12	2.0	.60
3	3.3	8.3	21	15	15	12	26	12	3.3	.10	1.8	.73
4	3.1	8.3	19	14	14	12	38	12	3.5	.08	6.0	1.0
5	2.8	8.2	18	13	13	12	35	11	3.2	.06	9.0	1.3
6	2.9	7.6	16	12	12	12	35	11	2.7	.06	12	1.0
7	2.8	7.2	15	11	11	15	44	10	2.2	.06	9.0	.92
8	2.7	7.0	18	10	10	23	38	9.4	2.0	.05	6.0	.76
9	2.5	7.1	29	9.5	10	41	33	10	1.7	.04	4.0	.65
10	2.5	6.6	28	9.0	10	34	29	11	1.5	.05	2.5	.51
11	2.7	6.4	26	10	10	32	26	11	1.3	.05	1.5	.46
12	2.7	6.2	26	9.5	10	37	25	9.7	1.2	.04	1.6	.53
13	2.4	6.1	24	8.5	10	45	23	9.1	1.1	.04	1.7	.62
14	2.3	5.9	22	7.5	10	38	25	8.3	1.1	.04	1.5	.50
15	2.3	5.6	29	7.5	13	35	24	8.0	1.4	.04	1.3	.34
16	2.3	5.6	39	7.5	14	30	23	9.8	1.7	.12	2.0	.29
17	2.7	6.1	34	11	13	28	21	8.8	1.8	6.0	6.0	.40
18	3.1	7.4	31	25	13	28	21	8.0	1.8	4.0	13	.41
19	3.0	7.0	29	22	13	28	19	7.5	1.7	2.0	6.0	.54
20	3.5	6.9	47	21	13	27	18	7.2	1.6	1.5	3.0	1.2
21	4.2	6.4	50	19	13	25	18	6.9	1.5	1.0	1.0	1.2
22	5.0	5.7	42	13	13	23	18	6.3	1.2	2.0	1.5	1.7
23	5.5	6.0	38	10	14	24	20	6.0	1.1	7.5	5.0	38
24	6.0	6.0	35	9.0	14	30	19	5.9	.92	4.0	3.0	16
25	7.0	21	35	8.5	13	32	18	5.0	.73	2.0	2.0	8.2
26	6.3	31	32	8.5	13	34	17	4.6	.55	8.0	1.4	6.3
27	11	24	29	13	12	31	16	3.9	.46	6.0	1.1	5.2
28	11	22	28	7.5	12	28	15	3.4	.41	3.0	1.3	4.3
29	9.8	25	25	7.0	11	27	15	3.1	.35	2.0	1.0	3.8
30	8.9	24	23	9.0	---	28	14	2.6	.25	2.2	.87	3.4
31	7.8	---	21	17	---	27	---	2.4	---	2.3	.76	---
TOTAL	139.9	311.6	875	380.5	372	822	722	248.9	47.47	54.63	110.93	101.52
MEAN	4.51	10.4	28.2	12.3	12.8	26.5	24.1	8.03	1.58	1.76	3.58	3.38
MAX	11	31	50	25	26	45	44	13	3.5	8.0	13	38
MIN	2.3	5.6	15	7.0	10	12	14	2.4	.25	.04	.76	.29
CFSM	.22	.50	1.35	.59	.61	1.27	1.15	.38	.08	.08	.17	.16
IN.	.25	.55	1.56	.68	.66	1.46	1.29	.44	.08	.10	.20	.18

CAL YR 1987 TOTAL 4254.78 MEAN 11.7 MAX 50 MIN .39 CFSM .56 IN 7.57
WTR YR 1988 TOTAL 4186.45 MEAN 11.4 MAX 50 MIN .04 CFSM .55 IN 7.45

04160900 CLINTON RIVER NEAR DRAYTON PLAINS, MI

LOCATION.--Lat 42°39'37", long 83°23'25", in NE1/4 sec.21, T.3 N., R.9 E., Oakland County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on State Highway 59, 1.0 mi downstream from State fish hatchery, and 2.0 mi south of Drayton Plains.

DRAINAGE AREA.--79.2 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 940 ft above National Geodetic Vertical Datum of 1929, from topographic map. Jan. 29 to July 9, 1964, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Some regulation and occasional diversion for lake-level control at many lakes upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 50.6 ft³/s, 8.68 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 276 ft³/s, Mar. 12, 1974, gage height, 4.95 ft; minimum, 2.4 ft³/s, May 31, 1961; minimum gage height, 1.23 ft, Jan. 4, 1961.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 175 ft³/s, Dec. 30, gage height, 4.20 ft; minimum, 4.8 ft³/s, June 25, July 14; minimum gage height, 2.05 ft, July 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	54	31	59	121	56	47	86	16	7.7	5.9	5.8	7.8
2	48	32	69	122	58	50	85	26	8.2	5.7	5.8	7.9
3	44	33	112	106	59	53	88	27	6.7	5.7	5.8	8.2
4	47	33	118	102	61	55	89	29	6.8	5.7	6.1	8.7
5	65	34	104	110	60	57	88	30	6.6	5.6	6.6	8.1
6	73	35	79	95	64	59	91	30	6.6	5.7	6.4	8.4
7	70	36	60	90	61	62	98	29	6.4	5.8	6.1	9.0
8	64	37	52	88	55	65	96	27	7.2	5.7	5.9	7.7
9	61	38	45	83	53	69	94	28	8.5	5.6	6.0	7.6
10	59	38	37	78	50	72	93	28	9.9	5.8	6.2	7.6
11	59	37	34	74	50	75	88	28	6.4	6.0	6.3	7.5
12	57	36	33	71	50	83	84	29	6.1	5.6	7.2	7.7
13	53	35	37	70	51	90	81	29	8.0	5.4	6.6	7.8
14	50	35	49	72	47	93	82	27	7.9	5.3	6.3	7.7
15	50	35	68	65	46	96	81	27	5.8	5.2	6.3	11
16	52	34	74	60	45	97	78	31	5.9	6.4	6.5	12
17	58	35	78	61	44	97	74	28	5.9	6.6	7.1	7.6
18	61	35	78	63	43	96	73	26	5.7	5.6	7.3	7.7
19	58	35	82	59	43	95	70	24	5.7	5.5	6.9	8.1
20	55	35	99	59	44	93	64	23	5.8	5.6	6.7	13
21	52	35	113	57	45	91	55	22	5.7	5.6	6.7	16
22	47	34	127	57	43	90	41	21	5.7	5.7	6.7	16
23	45	34	134	56	43	87	41	21	5.9	5.9	8.0	23
24	44	34	142	55	42	88	37	22	5.6	5.7	7.3	21
25	43	50	151	52	42	88	38	20	5.2	6.0	7.1	22
26	40	51	146	50	41	88	38	16	5.5	6.0	7.1	26
27	45	53	143	51	41	86	33	12	5.4	5.9	7.1	31
28	38	54	140	50	42	88	21	9.4	5.6	6.0	7.4	34
29	30	58	139	50	44	88	24	8.9	5.6	5.9	7.4	31
30	22	57	149	50	---	87	22	8.3	6.0	6.3	7.5	29
31	26	---	126	53	---	87	---	7.9	---	6.0	7.7	---
TOTAL	1570	1159	2877	2230	1423	2472	2033	710.5	194.0	179.4	207.9	420.1
MEAN	50.6	38.6	92.8	71.9	49.1	79.7	67.8	22.9	6.47	5.79	6.71	14.0
MAX	73	58	151	122	64	97	98	31	9.9	6.6	8.0	34
MIN	22	31	33	50	41	47	21	7.9	5.2	5.2	5.8	7.5
CFSM	.64	.49	1.17	.91	.62	1.01	.86	.29	.08	.07	.09	.18
IN.	.74	.54	1.35	1.05	.67	1.16	.95	.33	.09	.08	.10	.20

CAL YR 1987 TOTAL 16693.4 MEAN 45.7 MAX 151 MIN 8.3 CFSM .58 IN 7.84
WTR YR 1988 TOTAL 15475.9 MEAN 42.3 MAX 151 MIN 5.2 CFSM .53 IN 7.27

04161100 GALLOWAY CREEK NEAR AUBURN HEIGHTS, MI

LOCATION.--Lat 42°40'02", long 83°12'02", in SE1/4 sec.18, T.3 N., R.11 E., Oakland County, Hydrologic Unit 04090003, on right bank 12 ft downstream from wooden bridge on Oakland University property, and 2.7 mi northeast of Auburn Heights.

DRAINAGE AREA.--17.9 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 820.78 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.).

REMARKS.--Estimated daily discharges: Jan. 5, 6, Feb. 4-27, and Mar. 4, 5. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 10.7 ft³/s, 8.12 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 536 ft³/s, Aug. 24, 1985, gage height, 5.62 ft; maximum gage height, 6.27 ft, June 25, 1968; minimum discharge, 0.01 ft³/s, on many days during July and August, 1964; minimum gage height, 0.82 ft, Aug. 1, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 90 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 25	1800	99	3.92	Dec. 20	1130	138	a4.48
Dec. 15	1600	*145	*4.53	Sept. 23	0230	138	a4.48

a From graph based on gage readings.

Minimum discharge, 0.78 ft³/s, July 6, 7, 8, 14, gage height, 1.39 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.6	13	24	8.6	33	13	13	6.2	2.3	1.1	2.2	1.6
2	2.9	11	19	6.9	20	18	13	5.7	7.9	1.1	2.0	1.8
3	2.5	8.3	16	7.0	14	20	29	5.3	4.1	1.1	1.8	2.7
4	2.2	6.5	16	5.6	9.3	14	52	5.2	3.2	1.1	1.7	5.7
5	2.1	5.6	12	5.0	8.0	12	30	5.0	2.8	1.0	11	5.9
6	3.3	4.6	10	4.5	7.0	17	29	4.9	2.4	.94	27	3.3
7	2.7	3.9	9.4	4.0	6.0	23	50	4.7	2.2	.93	10	2.5
8	2.6	3.6	24	3.2	5.7	34	32	4.5	2.2	.94	4.9	2.0
9	2.2	3.8	38	3.1	5.4	51	23	5.9	2.0	1.0	3.1	1.7
10	2.1	3.3	25	2.7	5.2	40	19	5.9	1.7	1.1	2.7	1.4
11	2.5	3.1	18	2.6	5.0	31	16	5.1	[illegible]	1.1	2.3	1.4
12	2.3	3.1	22	3.0	5.0	42	14	4.9	[illegible]	.99	1.9	4.7
13	2.3	3.1	17	3.3	5.0	49	14	4.5	1.5	.96	3.7	3.8
14	2.1	3.0	13	2.9	5.0	33	15	4.1	1.3	.95	2.2	2.6
15	2.1	2.9	69	2.9	11	26	13	6.2	1.3	.97	1.7	2.3
16	2.2	2.9	70	2.9	9.8	21	12	14	1.8	2.2	1.6	2.0
17	2.9	5.4	41	18	9.2	18	10	7.6	1.8	51	7.8	2.4
18	3.0	9.2	27	40	10	19	13	5.8	1.7	15	25	2.8
19	2.6	5.4	26	17	9.5	18	9.8	5.0	1.5	6.7	11	3.9
20	3.8	4.6	98	27	9.0	16	8.4	5.0	1.5	3.8	5.5	15
21	3.8	3.7	75	20	8.0	13	9.0	4.7	1.2	3.3	3.6	7.2
22	3.5	3.1	45	11	12	12	7.9	4.4	1.1	5.7	2.7	5.5
23	4.8	3.6	32	8.1	20	13	14	4.3	1.1	11	12	78
24	12	3.7	28	6.7	15	18	12	4.2	1.1	4.9	8.3	31
25	10	68	26	5.8	10	20	9.1	3.4	1.0	4.4	5.7	15
26	6.9	56	21	5.5	9.0	21	8.2	3.2	1.0	32	3.3	6.7
27	32	27	17	5.0	8.8	18	7.7	2.9	1.0	10	2.6	6.1
28	17	18	14	5.3	8.5	16	8.1	2.8	1.1	5.3	3.1	4.7
29	10	38	13	4.5	11	15	7.6	2.9	1.1	3.5	2.4	3.8
30	7.6	27	9.8	11	---	16	6.8	2.6	1.1	2.6	2.0	3.3
31	5.7	---	9.9	27	---	14	---	2.4	---	3.1	1.8	---
TOTAL	165.3	354.4	885.1	280.1	294.4	691	505.6	153.3	57.6	179.78	176.6	232.8
MEAN	5.33	11.8	28.6	9.04	10.2	22.3	16.9	4.95	1.92	5.80	5.70	7.76
MAX	32	68	98	40	33	51	52	14	7.9	51	27	78
MIN	2.1	2.9	9.4	2.6	5.0	12	6.8	2.4	1.0	.93	1.6	1.4
CFSM	.30	.66	1.60	.51	.57	1.25	.94	.28	.11	.32	.32	.43
IN.	.34	.74	1.84	.58	.61	1.44	1.05	.32	.12	.37	.37	.48

CAL YR 1987 TOTAL 4254.29 MEAN 11.7 MAX 98 MIN .85 CFSM .65 IN 8.84
WTR YR 1988 TOTAL 3975.98 MEAN 10.9 MAX 98 MIN .93 CFSM .61 IN 8.26

04161540 PAINT CREEK AT ROCHESTER, MI

LOCATION.--Lat 42°41'18", long 83°08'35", in NW1/4 SE1/4 sec.10, T.3 N., R.11 E., Oakland County, Hydrologic Unit 04090003, on right bank at upstream side of bridge on Ludlow Street in Rochester, and 1.5 mi upstream from mouth.

DRAINAGE AREA.--70.9 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 755.11 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 21, Jan. 27 to Feb. 17, and Feb. 21-23. Records good except for estimated daily discharges, and those for August and September, which are fair. Occasional regulation by Lake Orion. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--29 years, 52.1 ft³/s, 9.98 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 918 ft³/s, Feb. 1, 1968; maximum gage height, 5.95 ft, Feb. 10, 1965, backwater from ice; minimum discharge, 1.2 ft³/s, Aug. 19, 1974, caused by regulation due to bridge construction; minimum gage height, 1.26 ft, Sept. 16, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 8	0100	ice jam	*3.63	Sept. 23	0300	303	3.34
Aug. 5	1730	*361	3.50				

Minimum discharge, 6.4 ft³/s, Aug. 15, 16, gage height, 1.38 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	46	58	70	49	47	69	42	20	11	12	7.7
2	23	46	56	65	50	50	66	41	23	11	12	7.4
3	22	43	53	60	50	52	83	40	19	11	11	10
4	20	42	53	52	50	45	109	39	17	10	10	16
5	21	41	49	48	50	45	85	38	15	10	49	15
6	23	41	48	48	49	50	89	37	15	10	45	11
7	22	39	47	48	48	63	135	35	14	10	15	9.5
8	22	39	59	49	47	91	101	32	14	9.9	12	8.2
9	21	40	76	50	47	131	87	34	15	9.6	11	8.0
10	21	37	63	51	46	88	83	36	14	9.8	11	7.5
11	21	37	57	54	46	82	77	32	14	11	10	7.4
12	20	37	63	50	46	110	73	32	13	9.6	8.1	11
13	20	36	58	46	46	126	70	30	13	9.7	7.9	12
14	20	36	53	42	47	109	73	25	13	8.8	7.5	9.3
15	25	35	141	41	47	113	69	27	12	8.5	6.8	8.0
16	48	36	126	41	47	112	65	34	13	26	7.2	8.1
17	50	40	84	43	48	103	63	27	12	82	12	9.4
18	48	43	71	50	49	100	65	25	13	23	24	10
19	43	37	71	54	48	94	58	30	12	17	14	11
20	44	35	196	55	48	87	53	32	12	15	11	23
21	45	34	152	52	47	79	44	31	12	15	10	14
22	43	33	108	51	47	75	42	30	12	43	9.2	18
23	44	34	100	49	50	77	39	28	12	23	21	165
24	53	36	107	48	54	88	35	26	11	17	17	49
25	50	119	113	46	49	86	33	24	11	23	12	37
26	42	77	107	45	47	87	36	23	10	53	9.5	32
27	77	51	100	44	46	82	38	23	10	20	9.2	28
28	54	47	97	43	46	78	39	22	11	15	10	27
29	47	72	92	42	46	77	41	21	12	13	9.4	25
30	43	59	85	42	---	78	41	20	10	13	8.5	23
31	41	---	80	45	---	74	---	20	---	14	8.3	---
TOTAL	1099	1348	2623	1524	1390	2579	1961	936	404	561.9	420.6	627.5
MEAN	35.5	44.9	84.6	49.2	47.9	83.2	65.4	30.2	13.5	18.1	13.6	20.9
MAX	77	119	196	70	54	131	135	42	23	82	49	165
MIN	20	33	47	41	46	45	33	20	10	8.5	6.8	7.4
CFSM	.50	.63	1.19	.69	.68	1.17	.92	.43	.19	.26	.19	.30
IN.	.58	.71	1.38	.80	.73	1.35	1.03	.49	.21	.29	.22	.33

CAL YR 1987 TOTAL 16406.0 MEAN 44.9 MAX 196 MIN 12 CFSM .63 IN 8.61
WTR YR 1988 TOTAL 15474.0 MEAN 42.3 MAX 196 MIN 6.8 CFSM .60 IN 8.12

04161580 STONY CREEK NEAR ROMEO, MI

LOCATION.--Lat 42°48'03", long 83°05'25", in SW1/4 sec.31, T.5 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on right bank at upstream side of culvert on Romeo Road, and 4.0 mi west of Romeo.

DRAINAGE AREA.--25.6 mi².

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 861.64 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 29 to Jan. 16, Jan. 27, 28, Feb. 3-26, 28, and Mar. 4. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 17.4 ft³/s, 9.23 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 290 ft³/s, Apr. 19, 1975, gage height, 5.19 ft; minimum, 0.92 ft³/s, Oct. 5, 9, 1967; minimum gage height, 1.28 ft, July 27, 28, 1965.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 67 ft³/s, Dec. 21, gage height, 2.96 ft, no peak discharge above base discharge of 100 ft³/s; minimum, 1.2 ft³/s, July 8, 9, gage height, 1.42 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.3	7.3	35	25	36	16	30	8.6	3.2	2.0	2.5	2.4
2	4.8	21	31	23	27	17	28	7.8	5.9	1.9	2.0	2.2
3	4.6	26	27	21	23	17	36	7.5	4.2	1.8	1.9	3.3
4	4.2	25	26	19	20	16	49	7.1	3.5	1.7	1.9	4.1
5	4.2	21	23	18	18	15	43	6.6	3.2	1.6	4.7	4.3
6	4.8	9.9	25	16	17	16	39	6.5	3.1	1.5	13	2.9
7	4.6	16	27	15	17	21	42	6.1	2.8	1.5	5.0	4.4
8	4.5	19	30	14	17	30	31	6.0	2.8	1.5	3.2	4.2
9	4.3	20	39	13	17	49	24	7.3	3.1	1.3	2.9	3.7
10	4.3	17	40	13	16	48	24	8.9	2.8	1.4	4.7	3.2
11	4.4	15	37	14	16	47	28	7.3	2.7	1.7	3.3	2.2
12	4.5	13	37	13	16	53	26	6.5	2.7	1.5	2.9	2.4
13	4.3	13	36	12	16	57	23	5.9	2.7	1.4	3.3	3.0
14	4.6	14	34	11	16	47	24	5.4	2.7	1.4	2.8	2.6
15	4.6	16	44	11	16	43	23	7.9	2.6	1.3	2.5	3.0
16	4.4	17	54	15	16	37	20	15	2.5	2.0	2.1	3.0
17	5.0	17	51	22	17	33	19	10	2.5	7.5	2.2	3.3
18	5.9	19	45	31	17	32	19	8.4	2.4	3.6	2.9	3.3
19	5.8	14	42	22	17	31	16	11	2.2	3.0	2.5	3.6
20	6.6	12	60	25	17	29	15	11	2.2	2.6	2.1	6.1
21	7.2	9.3	64	24	17	26	16	9.3	2.1	2.4	2.1	4.6
22	6.8	7.3	58	19	17	23	14	6.0	2.2	2.2	1.8	6.3
23	8.2	7.0	52	16	18	26	18	5.3	2.2	2.2	3.3	27
24	8.8	7.9	49	16	18	35	16	5.8	2.0	2.2	3.7	14
25	11	30	48	16	17	35	12	4.7	2.0	2.4	2.7	6.9
26	7.0	34	44	16	16	36	11	4.7	2.0	7.1	3.9	6.3
27	14	25	40	15	16	32	9.7	7.5	2.0	3.5	3.8	13
28	12	27	37	14	16	26	11	6.0	2.0	2.7	3.8	13
29	8.1	35	34	14	16	32	11	4.6	2.0	2.4	3.1	12
30	6.6	36	31	16	---	36	9.4	3.8	1.9	2.4	2.7	11
31	6.2	---	28	29	---	33	---	3.4	---	3.4	2.5	---
TOTAL	191.6	550.7	1228	548	523	994	687.1	221.9	80.2	75.1	101.8	181.3
MEAN	6.18	18.4	39.6	17.7	18.0	32.1	22.9	7.16	2.67	2.42	3.28	6.04
MAX	14	36	64	31	36	57	49	15	5.9	7.5	13	27
MIN	4.2	7.0	23	11	16	15	9.4	3.4	1.9	1.3	1.8	2.2
CFSM	.24	.72	1.55	.69	.70	1.25	.90	.28	.10	.10	.13	.24
IN.	.28	.80	1.78	.80	.76	1.44	1.00	.32	.12	.11	.15	.26

CAL YR 1987 TOTAL 5922.4 MEAN 16.2 MAX 64 MIN 2.4 CFSM .63 IN 8.61
WTR YR 1988 TOTAL 5382.7 MEAN 14.7 MAX 64 MIN 1.3 CFSM .57 IN 7.82

04161790 STONY LAKE NEAR WASHINGTON, MI

LOCATION.--Lat 42°42'58", long 83°05'58", in SE1/4 sec.31, T.4 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank 1,000 ft east of bridge over dam on Stony Creek, 2.7 mi west of Washington.

DRAINAGE AREA.--68.0 mi².

PERIOD OF RECORD.--February 1963 to current year.

REVISED RECORDS.--WDR MI-77-1: 1976.

GAGE.--Water-stage recorder. Datum of gage is 790.00 ft above National Geodetic Vertical Datum of 1929 (levels by Huron-Clinton Metropolitan Authority); gage readings have been converted to elevations NGVD.

REMARKS.--Reservoir is formed by an earthfill dam with concrete spillway completed in 1962. The spillway section includes a drum gate with minimum crest elevation of 796 ft, maximum of 802 ft; and 2 sluices, one on each side, with valve controls capable of draining lake. Total capacity (new capacity table put into use Oct. 1, 1973), 4,649 acre-ft at elevation of 802 ft. The reservoir began filling February 1963. Lake is used for recreational purposes.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 5,495 acre-ft, May 17, 18, 1974, Apr. 20, 1975, elevation, 803.6 ft; minimum recorded, 1,758 acre-ft, Nov. 21, 1967, elevation, 794.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 4,977 acre-ft, Dec. 20, 21, elevation, 802.63 ft; minimum, 3,951 acre-ft, July 15, 16, elevation, 800.58 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	802.23	4,769	--	--
Oct. 31	802.27	4,789	+20	+0.3
Nov. 30	802.49	4,904	+115	+1.9
Dec. 31	802.15	4.727	-177	-2.9
CAL YR 1987	--	--	+752	+1.0
Jan. 31	801.00	4,153	-574	-9.3
Feb. 29	800.98	4,143	-10	-0.2
Mar. 31	801.13	4,215	+72	+1.2
Apr. 30	801.85	4,574	+359	+6.0
May 31	801.85	4,574	0	0.0
June 30	800.71	4,014	-560	-9.4
July 31	801.23	4,264	+250	+4.1
Aug. 31	801.56	4,429	+165	+2.7
Sept. 30	801.70	4,499	+70	+1.2
WTR YR 1988	--	--	-270	-0.4

04161800 STONY CREEK NEAR WASHINGTON, MI

LOCATION.--Lat 42°42'55", long 83°05'31", in SW1/4 sec.31, T.4 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on Mt. Vernon Road, 500 ft downstream from Stony Lake Dam, and 2.9 mi west of Washington.

DRAINAGE AREA.--68.2 mi².

PERIOD OF RECORD.--July 1958 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 772.59 ft above National Geodetic Vertical Datum of 1929 (levels by Huron-Clinton Metropolitan Authority).

REMARKS.--Estimated daily discharges: Dec. 11-15. Records good except for estimated daily discharges, which are fair. Occasional diurnal fluctuation caused by mills upstream from station prior to February 1963; occasional regulation by Stony Lake since (see preceding page). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 42.7 ft³/s, 8.50 in/yr, adjusted for storage since 1963.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 552 ft³/s, June 10, 1988, gage height, 6.44 ft, from rating curve extended above 380 ft³/s, caused by momentary release of water from Stony Lake; maximum gage height, 6.71 ft, Mar. 6, 1959, backwater from ice; minimum discharge, 0.9 ft³/s, July 10, 1963; minimum gage height, 1.79 ft, Apr. 6, 1979; minimum daily discharge, 1.3 ft³/s, July 31, Aug. 2, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 552 ft³/s, June 10, gage height, 6.44 ft, from rating curve extended above 380 ft³/s, caused by momentary release of water from Stony Lake; minimum, 3.4 ft³/s, July 1, 2; minimum gage height, 1.93 ft, Aug. 20, 21, 22, 23.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	22	31	82	68	60	42	68	32	13	3.5	8.5	6.1
2	21	31	77	71	66	42	64	30	16	3.5	10	6.0
3	19	33	74	61	60	45	68	27	17	3.6	15	7.0
4	13	38	69	64	58	44	82	27	8.9	3.6	11	9.7
5	11	41	60	69	53	43	91	24	8.5	3.6	21	13
6	14	38	55	70	48	43	100	23	8.2	3.7	37	8.4
7	15	34	52	78	45	46	116	20	9.3	3.8	25	7.4
8	15	32	55	73	44	58	64	17	10	3.8	19	7.0
9	13	35	63	59	45	87	60	19	12	3.8	13	6.9
10	14	35	68	56	43	110	67	23	83	4.0	11	6.8
11	14	31	85	47	45	112	52	17	14	4.0	4.9	6.5
12	13	30	82	39	46	118	51	16	13	3.9	4.6	7.3
13	13	30	78	37	43	133	42	18	9.4	4.0	5.5	8.9
14	13	29	76	35	42	133	40	17	7.8	4.0	5.6	7.5
15	13	28	110	32	43	115	42	17	6.9	4.0	5.8	6.4
16	14	28	119	31	44	99	46	21	7.8	4.1	5.3	6.0
17	17	31	116	31	45	86	47	20	5.1	4.0	4.4	7.2
18	17	36	107	42	44	80	50	21	4.2	4.1	7.8	7.9
19	17	35	98	46	46	76	45	21	4.2	3.9	6.5	8.2
20	20	35	121	49	48	71	29	21	4.6	3.8	5.0	11
21	18	30	133	51	45	65	30	24	4.2	3.8	4.8	10
22	19	25	133	49	44	60	30	25	4.6	3.8	3.8	11
23	23	23	121	46	46	58	35	25	5.6	3.7	4.0	67
24	27	23	110	43	49	63	39	27	4.0	3.7	4.8	59
25	30	47	101	39	48	70	33	17	4.8	3.9	5.0	47
26	29	72	93	37	46	77	32	13	5.1	4.4	5.1	36
27	36	74	85	36	44	77	32	12	3.8	4.9	5.3	26
28	39	69	95	34	42	72	35	13	3.8	6.3	6.5	25
29	38	76	91	34	42	67	35	14	3.8	7.0	6.5	20
30	35	79	74	35	---	68	33	13	3.6	8.5	6.4	21
31	32	---	72	44	---	70	---	12	---	10	6.1	---
TOTAL	634	1179	2755	1506	1374	2330	1558	626	306.2	136.7	284.2	477.2
MEAN	20.5	39.3	88.9	48.6	47.4	75.2	51.9	20.2	10.2	4.41	9.17	15.9
MAX	39	79	133	78	66	133	116	32	83	10	37	67
MIN	11	23	52	31	42	42	29	12	3.6	3.5	3.8	6.0
MEAN+	20.8	41.2	86.0	39.3	47.2	76.4	57.9	20.2	.81	8.51	11.9	17.1
CFSM+	.30	.60	1.26	.58	.69	1.12	.85	.30	.01	.12	.17	.25
IN+	.35	.67	1.45	.66	.75	1.29	.95	.34	.01	.14	.20	.28

CAL YR 1987 TOTAL 14483.1 MEAN 39.7 MAX 133 MIN 5.0 MEAN+ 40.7 CFSM+ .60 IN+ 8.10
WTR YR 1988 TOTAL 13166.3 MEAN 36.0 MAX 133 MIN 3.5 MEAN+ 35.6 CFSM+ .52 IN+ 7.10

+ Adjusted for change in contents in Stony Lake.

04162010 RED RUN NEAR WARREN, MI

LOCATION.--Lat 42°31'46", long 83°04'07", in SE1/4 NE1/4 sec.6, T.1 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at upstream side of bridge on Ryan Road, 1.0 mi northwest of Warren.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--October 1979 to September 1988 (discontinued).

GAGE.--Water-stage recorder. Elevation of gage is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 31 to Jan. 16 and Feb. 4-27. Records fair. Diversion from Big Beaver Creek basin via Henry-Graham Drain started in 1976, is ongoing and increasing with further development of new drains. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--9 years, 29.3 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,940 ft^3/s, Oct. 1, 1981, gage height, 30.2 ft, from floodmark, from rating curve extended above 1,500 ft^3/s; minimum daily, 0.30 ft^3/s, Sept. 11, 1983.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,100 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov. 25	1515	1,140	15.30	July 17	0500	*1,860	*20.50
Dec. 15	1130	1,760	19.74	Sept. 23	0145	1,830	20.32

Minimum daily discharge, 2.1 ft^3/s, Aug. 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	67	57	9.0	45	19	6.3	5.3	3.6	4.0	4.1	2.6
2	5.2	17	28	8.0	25	34	8.2	5.5	84	4.9	4.2	2.7
3	4.2	11	38	7.0	15	27	68	6.4	6.3	4.7	4.3	63
4	3.9	9.8	39	6.0	11	16	49	5.4	3.5	4.2	35	144
5	12	6.1	20	5.0	8.5	15	17	4.9	2.5	3.4	49	94
6	30	4.7	15	4.5	7.5	17	83	4.7	3.0	3.6	59	16
7	13	4.3	20	4.0	6.6	22	98	4.3	2.9	3.9	8.6	7.4
8	7.3	4.7	74	3.8	6.4	29	26	4.7	2.7	4.2	4.6	5.2
9	6.4	8.3	137	3.6	6.2	36	16	74	3.1	4.2	4.2	4.8
10	5.8	4.3	33	3.5	5.9	21	13	27	3.2	3.6	4.9	4.0
11	15	4.8	36	3.7	5.5	17	12	7.8	3.6	4.6	3.5	3.6
12	5.7	3.6	44	4.5	5.8	77	11	5.5	3.3	3.5	3.2	27
13	5.5	3.8	20	7.0	6.0	38	9.8	6.7	3.5	3.4	5.1	9.1
14	3.8	3.7	16	3.7	6.2	25	18	4.1	4.0	3.6	2.6	5.2
15	3.4	3.6	634	3.6	7.0	17	11	52	3.8	3.2	2.1	3.7
16	3.3	3.5	105	4.8	9.0	14	7.6	51	4.1	42	3.1	3.2
17	16	31	37	82	11	12	7.6	8.4	3.8	508	65	2.9
18	5.4	20	24	67	13	14	23	5.1	3.7	21	80	4.8
19	3.8	7.6	60	12	11	13	8.1	6.3	3.5	9.4	12	7.1
20	17	5.3	300	36	9.0	11	9.6	6.3	3.7	4.2	7.0	40
21	12	4.5	45	15	10	8.6	13	7.0	4.0	3.5	3.6	6.0
22	16	4.0	28	8.7	15	6.9	5.5	4.1	4.0	4.8	3.1	39
23	14	6.6	24	8.0	37	7.7	29	6.1	3.7	16	70	425
24	100	4.9	31	13	21	9.5	7.5	4.2	3.7	4.2	15	17
25	23	408	41	9.9	14	13	6.5	3.0	3.8	12	5.4	7.1
26	10	49	19	11	11	9.5	8.4	3.2	3.5	80	3.6	5.7
27	149	20	15	9.1	11	6.9	8.6	4.0	3.6	9.9	3.0	3.6
28	20	16	13	7.1	12	15	21	2.7	4.6	7.4	15	3.1
29	11	118	13	7.1	19	14	7.3	2.8	4.5	4.3	4.1	2.7
30	7.7	44	12	17	---	12	5.6	3.2	4.8	4.7	3.2	3.1
31	6.1	---	10	34	---	7.3	---	3.5	---	6.6	3.3	---
TOTAL	545.5	899.1	1988	418.6	370.6	584.4	614.6	339.2	192.0	797.0	490.8	962.6
MEAN	17.6	30.0	64.1	13.5	12.8	18.9	20.5	10.9	6.40	25.7	15.8	32.1
MAX	149	408	634	82	45	77	98	74	84	508	80	425
MIN	3.3	3.5	10	3.5	5.5	6.9	5.5	2.7	2.5	3.2	2.1	2.6

CAL YR 1987 TOTAL 9842.6 MEAN 27.0 MAX 634 MIN 3.2
WTR YR 1988 TOTAL 8202.4 MEAN 22.4 MAX 634 MIN 2.1

04162900 BIG BEAVER CREEK NEAR WARREN, MI

LOCATION.--Lat 42°32'31", long 83°02'52", in NW1/4 SW1/4 sec.33, T.2 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank between bridges on Mound Road, 1.0 mi north of Warren, and 2.0 mi upstream from mouth.

DRAINAGE AREA.--Indeterminate since 1976. Prior to 1976, 23.5 mi².

PERIOD OF RECORD.--October 1958 to September 1988 (discontinued).

GAGE.--Water-stage recorder. Datum of gage is 598.80 ft, Macomb County datum. Prior to Aug. 26, 1960, nonrecording gage and crest-stage gage at same site and datum.

REMARKS.--Estimated daily discharges: Oct. 1, 2, Dec. 31 to Jan. 17, Jan. 24 to Feb. 29, and June 5-29. Records fair except for period of estimated daily discharges, June 5-29, which is poor. Diversion from the basin via Henry-Graham Drain started in 1976, is ongoing and increasing with further development of new drains. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--18 years (water years 1959-76), 13.9 ft³/s; 12 years (water years 1977-88), 4.37 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,240 ft³/s, June 26, 1968, gage height, 14.45 ft; no flow on several days in June and July 1962, caused by unusual regulation upstream from gage; minimum discharge affected by diversion since 1976.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 209 ft³/s, Dec. 15, gage height, 7.99 ft; minimum daily, 0.04 ft³/s, Sept. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.80	3.3	6.7	1.6	3.5	2.6	.94	.53	.37	.19	.15	.05
2	.55	1.8	4.5	1.4	2.5	4.0	.93	.53	6.4	.18	.22	.04
3	.29	.86	4.3	1.1	1.5	4.1	4.5	.57	.82	.21	.26	2.9
4	.30	.76	5.8	.90	1.0	2.0	5.1	.63	.51	.26	18	12
5	.44	.49	3.3	.80	.80	1.9	1.7	.55	.30	.26	17	13
6	1.7	.42	2.5	.70	.62	1.8	6.6	.56	.29	.25	11	2.2
7	.84	.35	2.6	.60	.58	2.4	13	.53	.28	.27	1.7	1.1
8	.62	.35	7.2	.55	.54	3.4	2.8	.54	.27	.28	.69	.43
9	.46	.58	17	.47	.50	4.2	1.4	1.9	.27	.26	.64	.30
10	.38	.55	5.4	.45	.50	3.0	1.1	1.8	.50	.26	.52	.20
11	.77	.36	4.4	.42	.50	2.1	.96	.58	.40	.27	.41	.17
12	.61	.32	5.9	.40	.50	6.1	.93	.34	.28	.30	.39	.75
13	.40	.29	3.3	.40	.50	5.7	.84	.30	.27	.33	.33	1.1
14	.33	.29	2.6	.40	.55	3.0	.96	.27	.27	.27	.36	.38
15	.37	.29	74	.40	.60	2.3	.87	2.4	.26	.17	.31	.18
16	.40	.29	17	1.0	.75	1.7	.84	4.4	.27	1.3	.35	.13
17	.87	1.1	7.7	10	1.0	1.5	.68	.96	.27	45	4.7	.10
18	.78	1.9	3.9	12	1.1	1.5	1.5	.47	.25	4.6	12	.13
19	.60	.62	7.2	3.9	1.0	1.4	.70	.38	.24	1.4	2.7	.40
20	1.0	.36	36	7.2	.80	1.2	.64	.40	.23	.75	.86	1.8
21	1.2	.26	9.8	3.7	.80	1.1	.92	.98	.23	.45	.58	.87
22	1.1	.23	4.5	2.2	1.2	.96	.64	.79	.28	.38	.39	1.2
23	1.7	.34	3.5	1.7	3.0	1.2	1.4	.44	.25	.76	4.0	46
24	8.9	.34	4.2	1.1	1.8	1.3	.81	.39	.24	.71	2.5	3.7
25	3.7	43	6.6	.80	1.2	1.3	.58	.29	.23	.51	.68	1.5
26	.82	9.6	3.5	.66	.98	1.2	.56	.24	.22	5.1	.33	.72
27	16	3.3	2.9	.64	.95	.97	.71	.27	.21	.82	.25	.52
28	2.2	3.0	3.0	.62	.95	1.2	1.2	.22	.21	.52	.81	.38
29	.82	14	2.7	.62	1.1	1.8	.91	.27	.20	.51	.44	.50
30	.47	6.7	2.3	1.5	---	1.4	.58	.28	.27	.24	.19	.35
31	.39	---	2.0	2.5	---	1.2	---	.30	---	.18	.11	---
TOTAL	49.81	96.05	266.3	60.73	31.32	69.53	55.30	23.11	15.09	66.99	82.87	93.10
MEAN	1.61	3.20	8.59	1.96	1.08	2.24	1.84	.75	.50	2.16	2.67	3.10
MAX	16	43	74	12	3.5	6.1	13	4.4	6.4	45	18	46
MIN	.29	.23	2.0	.40	.50	.96	.56	.22	.20	.17	.11	.04

CAL YR 1987 TOTAL 1076.35 MEAN 2.95 MAX 74 MIN .06
WTR YR 1988 TOTAL 910.20 MEAN 2.49 MAX 74 MIN .04

04163400 PLUM BROOK AT UTICA, MI

LOCATION.--Lat 42°36'05", long 83°04'27", in SE1/4 NE1/4 sec.7, T.2 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at upstream side of bridge on Ryan Road, 1.0 mi southwest of Utica.

DRAINAGE AREA.--16.5 mi².

PERIOD OF RECORD.--July 1965 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 619.79 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.).

REMARKS.--Estimated daily discharges: Dec. 28 to Jan. 27 and Feb. 2 to Mar. 4. Records good except for estimated daily discharges, which are fair. Occasional diversion for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 13.2 ft³/s, 10.86 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,160 ft³/s, June 26, 1968, gage height, 10.36 ft; no flow part of each day July 19, 28, 1966, Aug. 22-28, Sept. 3, 11, 1969.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 15	2200	*233	*6.89	No other peak greater than base discharge.			

Minimum discharge, 0.01 ft³/s, July 9, gage height, 1.54 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.9	12	39	6.0	27	15	7.3	4.5	1.2	.07	1.1	.79
2	3.0	15	33	5.0	18	19	6.9	4.7	11	.16	1.4	.53
3	2.2	10	19	4.6	13	16	12	4.1	7.8	.13	1.6	3.9
4	1.8	8.2	27	4.2	9.5	14	49	3.5	2.8	.10	1.8	11
5	1.8	5.9	17	4.0	8.5	13	21	3.2	1.9	.08	5.8	27
6	4.5	4.4	13	3.8	7.5	13	22	3.2	1.6	.21	65	9.0
7	4.7	3.6	16	3.6	6.8	20	63	3.1	1.4	.19	11	7.0
8	3.6	4.8	38	3.5	6.2	26	25	2.7	1.1	.07	4.7	3.7
9	2.7	5.4	61	3.4	5.8	30	16	7.5	1.7	.05	3.7	1.8
10	2.3	4.7	32	3.3	5.6	25	13	18	1.4	.22	3.3	.83
11	2.7	4.2	19	3.3	5.4	17	14	8.8	1.1	.31	1.7	1.0
12	2.7	4.1	27	3.3	5.6	28	12	4.8	.94	.26	1.7	3.5
13	2.7	3.7	18	3.4	5.8	41	11	4.0	.78	.11	1.3	4.9
14	2.8	3.5	17	3.4	6.0	23	11	2.9	.61	.14	1.1	2.1
15	2.7	3.7	114	3.5	6.4	18	10	3.9	.84	.21	.70	1.3
16	1.9	3.0	107	3.9	8.0	16	9.2	20	1.3	.61	1.1	1.5
17	2.2	4.0	48	9.0	9.5	13	8.6	12	1.3	18	6.0	1.1
18	2.4	12	29	30	10	13	12	6.4	1.2	13	35	1.6
19	2.3	6.8	23	15	9.8	15	8.6	4.0	.77	6.4	12	2.3
20	3.1	4.8	116	13	9.0	11	6.9	4.1	.56	3.5	4.0	4.9
21	3.6	3.7	63	11	8.5	10	8.2	3.4	.47	2.2	1.7	4.8
22	3.7	3.1	40	9.0	16	8.7	6.7	3.0	.45	2.1	1.8	3.2
23	5.5	3.4	26	7.5	35	8.9	8.3	3.5	.51	45	6.7	61
24	12	4.0	20	7.0	25	9.9	8.4	2.5	.69	8.6	11	15
25	21	60	23	6.5	20	11	6.2	2.0	.52	4.9	7.9	6.9
26	6.7	59	17	6.2	14	12	6.5	1.7	.29	15	2.8	4.6
27	38	22	14	6.0	11	9.6	5.8	1.3	.35	7.5	1.5	3.2
28	20	14	13	4.9	11	8.7	7.3	1.3	.35	5.2	1.9	6.5
29	9.4	50	12	4.5	11	9.8	7.0	1.3	.20	2.5	1.7	6.3
30	6.5	43	10	6.7	---	9.5	5.5	1.3	.08	2.3	1.4	4.4
31	8.2	---	8.0	18	---	8.6	---	1.9	---	1.8	1.6	---
TOTAL	190.6	386.0	1059.0	216.5	334.9	500.7	408.4	148.6	45.21	140.92	204.00	205.65
MEAN	6.15	12.9	34.2	6.98	11.5	16.2	13.6	4.79	1.51	4.55	6.58	6.86
MAX	38	60	116	30	35	41	63	20	11	45	65	61
MIN	1.8	3.0	8.0	3.3	5.4	8.6	5.5	1.3	.08	.05	.70	.53
CFSM	.37	.78	2.07	.42	.70	.98	.82	.29	.09	.28	.40	.42
IN.	.43	.87	2.39	.49	.76	1.13	.92	.34	.10	.32	.46	.46

CAL YR 1987 TOTAL 3965.54 MEAN 10.9 MAX 116 MIN .53 CFSM .66 IN 8.94
WTR YR 1988 TOTAL 3840.48 MEAN 10.5 MAX 116 MIN .05 CFSM .64 IN 8.66

04164000 CLINTON RIVER NEAR FRASER, MI

LOCATION.--Lat 42°34'40", long 82°57'00", in NW1/4 sec.20, T.2 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on left bank 800 ft downstream from bridge on Garfield Road, 2.8 mi north of Fraser, and 4.0 mi upstream from North Branch.

DRAINAGE AREA.--444 mi^2.

PERIOD OF RECORD.--May 1947 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 577.71 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 17, 1949, nonrecording gage at site 800 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Jan. 3-12. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--41 years, 380 ft^3/s, 11.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,840 ft^3/s, Oct. 1, 1981, gage height, 19.56 ft; minimum, 47 ft^3/s, Sept. 6, 1955; minimum gage height, 4.29 ft, Sept. 7, 1954.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20 ft, from floodmark, discharge, 9,000 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,000 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov. 25	2000	2,200	13.39	July 17	0900	3,320	14.84
Dec. 15	1500	*3,590	*15.30	Sept. 23	0600	3,060	14.22

Minimum discharge, 74 ft^3/s, July 4; minimum gage height, 4.81 ft, Sept. 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	226	436	599	485	599	379	383	212	131	91	144	102
2	183	443	568	376	512	365	376	194	505	88	234	101
3	193	315	505	360	402	468	496	187	199	87	470	166
4	187	294	577	350	382	353	775	180	146	81	286	313
5	181	282	451	320	351	337	544	175	126	86	338	581
6	271	268	388	300	317	335	488	165	121	96	931	166
7	199	256	363	305	309	403	973	160	122	93	325	133
8	198	247	565	305	303	454	600	153	118	93	193	117
9	181	264	901	310	312	603	412	223	120	93	177	116
10	188	248	648	310	314	584	379	284	116	86	165	103
11	232	245	511	330	301	525	358	178	237	93	156	97
12	203	238	644	350	296	628	326	157	123	91	148	157
13	198	234	507	335	300	793	310	159	113	87	166	169
14	194	230	431	273	297	642	348	150	112	87	141	112
15	184	221	1940	279	506	580	341	179	108	88	127	101
16	165	221	1740	301	486	530	327	507	114	100	128	97
17	202	249	936	461	416	494	318	287	112	2050	209	100
18	211	395	641	817	442	483	406	270	105	548	732	97
19	222	262	591	494	419	481	337	223	99	250	270	117
20	257	241	1430	522	507	437	312	234	95	192	163	248
21	354	231	1270	489	383	408	315	226	101	162	127	150
22	237	217	828	377	487	394	280	215	106	148	118	125
23	332	223	679	339	829	380	356	194	106	527	281	1960
24	463	223	650	342	512	424	299	188	103	257	251	659
25	511	1190	740	328	386	451	267	155	98	169	150	313
26	292	1220	594	309	352	466	261	145	97	490	123	245
27	754	566	551	287	337	430	255	145	93	233	110	217
28	597	454	529	281	314	413	251	138	98	176	143	199
29	359	800	533	287	350	465	224	130	96	158	115	198
30	295	612	459	319	---	426	241	127	93	151	108	185
31	273	---	487	468	---	411	---	129	---	199	103	---
TOTAL	8542	11325	22256	11409	11721	14542	11558	6069	3913	7150	7132	7444
MEAN	276	378	718	368	404	469	385	196	130	231	230	248
MAX	754	1220	1940	817	829	793	973	507	505	2050	931	1960
MIN	165	217	363	273	296	335	224	127	93	81	103	97
CFSM	.62	.85	1.62	.83	.91	1.06	.87	.44	.29	.52	.52	.56
IN.	.72	.95	1.86	.96	.98	1.22	.97	.51	.33	.60	.60	.62

CAL YR 1987 TOTAL 137152 MEAN 376 MAX 1950 MIN 114 CFSM .85 IN 11.49
WTR YR 1988 TOTAL 123061 MEAN 336 MAX 2050 MIN 81 CFSM .76 IN 10.31

04164100 EAST POND CREEK AT ROMEO, MI

LOCATION.--Lat 42°49'21", long 83°01'13", in NE1/4 SE1/4 sec.27, T.5 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on right bank at upstream side of bridge on State Highway 53, and 1.4 mi north of Romeo.

DRAINAGE AREA.--21.8 mi².

PERIOD OF RECORD.--September 1958 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 780 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30 to Jan. 16, Jan. 27, 28, Feb. 3-26, 28, and Mar. 4. Records good except for estimated daily discharges, which are fair. Occasional regulation by lakes upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 16.1 ft³/s, 10.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 358 ft³/s, Feb. 10, 1965, gage height, 4.48 ft; maximum gage height, 4.56 ft, Mar. 12, 1962, backwater from ice; minimum discharge, 0.8 ft³/s, July 30, 31, 1964, Aug. 6, 7, 1965; minimum gage height, 0.71 ft, July 21, 1959.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 70 ft³/s, Dec. 20, gage height, 2.03 ft, no peak discharge above base discharge of 80 ft³/s; maximum gage height, 2.19 ft, Jan. 5, backwater from ice; minimum discharge, 1.0 ft³/s, July 10, gage height, 0.76 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	12	15	36	22	28	16	26	12	4.7	2.8	4.6	2.4
2	11	17	36	20	26	17	26	13	7.3	2.2	3.8	2.4
3	9.7	17	32	18	24	18	27	13	6.7	2.2	3.3	2.4
4	9.1	16	31	16	21	18	31	12	6.2	2.1	3.1	3.3
5	8.8	14	28	15	19	18	31	11	5.5	2.2	5.2	4.4
6	9.4	13	26	14	18	19	30	11	5.2	2.2	14	3.8
7	9.0	12	24	13	18	25	35	9.6	4.7	2.1	9.9	3.4
8	8.6	12	25	12	17	35	32	8.9	5.8	2.1	6.9	3.1
9	8.4	12	29	11	17	47	30	10	11	2.0	5.9	2.9
10	8.0	12	29	11	17	45	27	11	4.5	1.9	6.9	2.6
11	8.4	12	27	12	17	44	26	11	4.3	2.0	6.0	2.6
12	8.4	11	30	11	16	51	24	10	4.0	1.8	5.2	3.0
13	8.1	11	29	9.5	16	56	22	9.6	3.7	1.5	4.8	3.5
14	8.0	10	27	9.5	16	49	17	9.1	3.3	1.9	3.8	3.1
15	8.0	10	41	9.5	16	44	18	9.0	3.1	2.0	3.2	2.8
16	7.7	11	49	18	16	40	18	11	3.2	2.1	3.2	2.6
17	6.2	12	44	38	17	37	18	9.9	3.2	5.0	3.4	2.8
18	7.8	14	39	61	17	34	19	9.4	3.0	3.2	3.5	3.0
19	8.5	13	36	42	18	32	18	9.1	2.9	2.8	3.4	3.9
20	9.8	12	60	23	18	30	17	9.2	2.4	2.4	2.9	5.9
21	11	11	59	21	18	27	17	8.9	2.2	2.5	2.6	5.1
22	11	11	53	20	18	25	17	8.6	2.1	2.4	2.5	4.7
23	13	12	48	16	19	26	16	8.3	2.1	2.6	4.0	21
24	18	11	44	15	19	28	17	8.3	2.1	3.4	4.8	15
25	18	35	41	15	18	29	17	7.7	2.2	3.4	4.2	9.2
26	16	46	37	16	17	30	22	7.9	2.1	8.0	3.4	6.6
27	23	39	34	16	17	29	15	7.7	2.2	6.6	3.1	5.7
28	22	36	32	15	16	28	15	7.0	2.3	5.5	3.2	5.4
29	20	42	30	16	16	29	16	4.8	2.3	4.3	3.1	4.9
30	22	40	27	18	---	29	15	4.7	2.3	4.3	2.7	4.7
31	16	---	25	27	---	27	---	4.9	---	5.6	2.6	---
TOTAL	364.9	539	1108	580.5	530	982	659	287.6	116.6	95.1	139.2	146.2
MEAN	11.8	18.0	35.7	18.7	18.3	31.7	22.0	9.28	3.89	3.07	4.49	4.87
MAX	23	46	60	61	28	56	35	13	11	8.0	14	21
MIN	6.2	10	24	9.5	16	16	15	4.7	2.1	1.5	2.5	2.4
CFSM	.54	.83	1.64	.86	.84	1.45	1.01	.43	.18	.14	.21	.22
IN.	.62	.92	1.89	.99	.90	1.68	1.12	.49	.20	.16	.24	.25

CAL YR 1987 TOTAL 6536.6 MEAN 17.9 MAX 201 MIN 3.2 CFSM .82 IN 11.15
WTR YR 1988 TOTAL 5548.1 MEAN 15.2 MAX 61 MIN 1.5 CFSM .70 IN 9.47

04164300 EAST BRANCH COON CREEK AT ARMADA, MI

LOCATION.--Lat 42°50'45", long 82°53'06", in NE1/4 sec.23, T.5 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on right bank at downstream side of bridge on Prospect Street in Armada.

DRAINAGE AREA.--13.0 mi².

PERIOD OF RECORD.--October 1958 to current year.

REVISED RECORDS.--WDR MI-83: 1982.

GAGE.--Water-stage recorder and concrete control. Elevation of gage is 735 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Jan. 5-12, 18-24, 27, 28, Feb. 2-8, 12, Mar. 3-8, 14-17, and June 13 to July 16. Records good except those for the winter period and period of estimated daily discharges June 13 to July 16, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 7.25 ft³/s, 7.57 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 910 ft³/s, Apr. 19, 1975, gage height, 6.69 ft; no flow Jan. 25 to Feb. 9, 1961, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 25	2300	198	3.64	Mar. 9	0200	189	3.57
Dec. 15	2400	238	3.92	Mar. 13	0100	148	3.27
Dec. 20	1400	*326	*4.45				

Minimum daily discharge, 0.05 ft³/s, July 11-15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.60	1.7	26	3.4	17	7.6	5.3	1.6	.45	.07	.14	.10
2	.51	1.9	21	2.8	5.0	11	4.9	1.5	.41	.07	.12	.11
3	.40	2.0	12	2.0	3.5	13	8.0	1.4	.24	.07	.09	.14
4	.43	1.8	11	1.9	3.0	9.0	32	1.3	.27	.07	.11	.15
5	.45	1.5	8.6	1.6	2.5	10	16	1.2	.16	.07	1.7	.14
6	.56	1.2	6.3	1.1	2.0	20	10	1.1	.12	.06	.44	.12
7	.69	1.2	4.7	1.0	1.6	50	32	1.1	.10	.06	.13	.13
8	.65	1.1	12	.90	1.3	85	19	.94	.10	.06	.11	.13
9	.57	.94	36	.80	1.1	131	9.8	1.3	.10	.06	.25	.13
10	.40	.94	31	.80	.79	49	6.8	1.4	.11	.06	.20	.14
11	.41	.89	16	.80	.69	33	5.4	1.2	.10	.05	.12	.14
12	.40	.81	22	.80	.68	54	4.5	1.0	.10	.05	.11	.16
13	.40	.81	17	.76	.68	94	3.9	.86	.09	.05	.10	.17
14	.32	.81	10	.81	.72	19	3.8	.81	.09	.05	.10	.19
15	.60	.70	69	.76	1.6	6.0	3.3	.86	.08	.05	.10	.23
16	.74	.68	120	.62	2.1	5.3	2.8	1.0	.08	.15	.11	.28
17	.75	.88	40	.64	2.4	6.5	2.5	.80	.08	.37	.11	.28
18	1.0	1.4	25	9.0	3.3	12	3.0	.69	.08	.11	.12	.33
19	1.1	1.4	16	6.0	3.2	16	2.6	.67	.08	.12	.11	.26
20	1.4	1.1	195	4.0	2.8	11	2.4	.61	.08	.12	.11	.34
21	1.6	.92	95	2.5	3.0	7.6	2.5	.59	.07	.13	.11	.24
22	1.9	.81	41	2.0	4.4	6.0	2.2	.55	.07	.15	.11	.38
23	1.9	.83	28	1.8	18	6.0	3.1	.52	.07	.65	.27	.98
24	2.1	1.1	18	1.7	16	11	3.2	.47	.07	.22	.14	.12
25	2.5	71	18	1.6	11	15	2.5	.40	.07	.20	.13	.10
26	2.1	83	15	1.4	7.0	17	2.2	.30	.07	.54	.10	.11
27	9.5	26	9.4	1.3	4.9	13	2.0	.22	.07	.14	.10	.10
28	9.6	16	7.2	1.2	3.9	8.4	2.0	.21	.08	.13	.11	.14
29	3.6	46	5.7	1.2	4.3	7.2	1.9	.17	.08	.14	.10	.16
30	2.1	37	4.5	2.5	---	7.1	1.7	.15	.08	.16	.10	.11
31	1.8	---	3.8	11	---	5.2	---	.13	---	.15	.10	---
TOTAL	51.16	306.42	944.2	68.69	128.46	746.9	201.3	25.05	3.65	4.38	5.75	6.11
MEAN	1.65	10.2	30.5	2.22	4.43	24.1	6.71	.81	.12	.14	.19	.20
MAX	9.6	83	195	11	18	131	32	1.6	.45	.65	1.7	.98
MIN	.32	.68	3.8	.62	.68	5.3	1.7	.13	.07	.05	.09	.10
CFSM	.13	.79	2.35	.17	.34	1.85	.52	.06	.009	.01	.02	.02
IN.	.15	.88	2.70	.20	.37	2.14	.58	.07	.01	.01	.02	.02

CAL YR 1987 TOTAL 2903.85 MEAN 7.96 MAX 195 MIN .09 CFSM .61 IN 8.31
WTR YR 1988 TOTAL 2492.07 MEAN 6.81 MAX 195 MIN .05 CFSM .52 IN 7.13

04164500 NORTH BRANCH CLINTON RIVER NEAR MOUNT CLEMENS, MI

LOCATION.--Lat 42°37'45", long 82°53'25", in SW1/4 sec.35, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on left bank 30 ft upstream from bridge on State Highway 59, 2 mi north of Mount Clemens, and 3.6 mi upstream from mouth.

DRAINAGE AREA.--199 mi².

PERIOD OF RECORD.--May 1947 to current year.

REVISED RECORDS.--WSP 1437: 1948. WSP 1557: Drainage area.

GAGE.--Water-stage recorder. Concrete control since September 1961. Datum of gage is 576.38 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Nov. 15, 1949, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Mar. 4-8. Records good except for estimated daily discharges and those below 1.0 ft³/s, which are fair. Some regulation at times by mill upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--41 years, 126 ft³/s, 8.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,700 ft³/s, Feb. 2, 1968, gage height, 18.62 ft; minimum, 0.08 ft³/s, part of each day July 4-10, 14, 15, 1988; minimum gage height, 3.12 ft, Sept. 13, 14, 1954.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20.0 ft, from floodmark.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 17	0200	*1,350	*12.51	Dec. 21	2200	1,320	12.47

Minimum discharge, 0.08 ft³/s, part of each day July 4-10, 14, 15, gage height, 3.73 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	38	92	606	156	206	176	141	66	13	.11	12	2.7
2	37	83	467	137	258	191	123	59	15	.11	11	1.8
3	34	99	377	88	172	266	124	54	19	.11	7.9	2.0
4	31	94	280	86	137	240	227	51	22	.10	3.9	4.8
5	29	83	261	68	117	190	322	47	17	.10	4.8	6.8
6	28	72	207	48	94	165	219	44	15	.10	28	8.0
7	29	61	172	49	80	220	318	41	12	.09	56	9.3
8	29	53	170	43	72	430	400	39	9.4	.11	35	7.7
9	28	50	365	40	75	728	277	39	9.9	.10	20	5.5
10	27	49	558	38	74	939	180	46	13	.11	14	5.1
11	27	48	509	32	71	705	149	54	11	.12	14	4.9
12	26	45	347	35	68	494	125	49	9.0	.12	15	3.6
13	26	42	364	38	67	634	108	43	8.4	.11	12	3.1
14	25	41	284	38	68	823	98	38	6.3	.10	9.6	4.5
15	25	40	353	34	72	509	93	36	4.0	.11	9.0	4.0
16	24	37	976	33	88	279	92	40	4.1	.22	6.1	4.3
17	24	37	1180	39	113	204	86	62	4.0	1.7	5.7	4.0
18	23	41	740	132	126	196	87	61	3.1	5.0	7.3	3.3
19	24	60	437	206	135	208	92	44	3.1	11	7.7	5.9
20	25	61	496	216	135	204	85	38	3.7	7.2	7.1	8.5
21	27	51	1070	199	123	174	79	38	3.4	4.7	5.5	13
22	32	40	1110	173	118	151	79	36	1.7	3.4	4.3	14
23	36	43	665	117	341	135	76	34	1.2	2.6	3.7	34
24	51	41	398	89	422	152	86	32	1.2	2.6	4.6	56
25	92	107	288	76	401	203	89	29	.92	11	10	36
26	132	586	261	70	264	229	78	25	.46	17	9.2	25
27	129	947	219	63	182	231	75	23	.56	19	7.7	17
28	245	666	186	48	150	193	69	21	.57	25	7.3	13
29	226	418	169	52	145	163	70	20	.22	15	6.1	11
30	158	554	155	54	---	158	71	17	.14	9.8	4.8	9.7
31	117	---	168	85	---	158	---	15	---	8.9	2.9	---
TOTAL	1804	4641	13838	2502	4374	9748	4118	1241	212.37	145.72	352.2	328.5
MEAN	58.2	155	446	83.3	151	314	137	40.0	7.08	4.70	11.4	11.0
MAX	245	947	1180	216	422	939	400	66	22	25	56	56
MIN	23	37	155	32	67	135	69	15	.14	.09	2.9	1.8
CFSM	.29	.78	2.24	.42	.76	1.58	.69	.20	.04	.02	.06	.06
IN.	.34	.87	2.59	.48	.82	1.82	.77	.23	.04	.03	.07	.06

CAL YR 1987 TOTAL 47501.50 MEAN 130 MAX 1300 MIN 5.8 CFSM .65 IN 8.88
WTR YR 1988 TOTAL 43384.79 MEAN 119 MAX 1180 MIN .09 CFSM .60 IN 8.11

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI
(National stream quality accounting network station)

LOCATION.--Lat 42°35'45", long 82°54'35", Macomb County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on Moravian Drive, 0.2 mi downstream from North Branch, and 0.5 mi west of Mount Clemens.

DRAINAGE AREA.--734 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1934 to current year.

REVISED RECORDS.--WSP 1084: 1943, 1945-46. WSP 1937: 1935, 1936(M), 1937-39, 1949(M), 1950. WSP 1557: Drainage area. WSP 1727: 1952(M), 1954(M).

GAGE.--Water-stage recorder. Datum of gage is 570.43 ft above National Geodetic Vertical Datum of 1929. May 10, 1934, to Jan. 11, 1939, nonrecording gage at same site and datum. Auxiliary gage is a water-stage recorder on right bank 2.0 mi downstream from base gage at same datum. Mar. 15, 1938, to Jan. 3, 1952, auxiliary nonrecording gage 1.6 mi downstream from base gage at same datum.

REMARKS.--Estimated daily discharges: Oct. 1-21, Dec. 30, Jan. 3-16, Feb. 6-14, Apr. 27, May 3-9, 13-15, May 18 to June 1, June 4 to July 16, July 19 to Sept. 2, and Sept. 8-10, 17-20, 28-30. Water-discharge records fair. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--54 years, 542 ft³/s, 10.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 21,200 ft³/s, Apr. 6, 1947, gage height, 23.55 ft, from floodmark; minimum not determined; minimum gage height, 2.72 ft, Nov. 29, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 15	2100	*4,180	*10.91	No other peak greater than base discharge.			

Minimum daily discharge, 94 ft³/s, July 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	300	600	1360	669	942	636	603	314	165	100	180	120
2	255	608	1210	607	846	638	577	273	533	100	300	120
3	260	470	1010	510	614	853	706	270	245	97	530	188
4	250	448	1050	490	539	684	1290	260	190	94	330	307
5	245	438	853	450	499	606	1070	250	160	105	390	708
6	330	406	701	400	460	589	900	235	155	110	1100	212
7	260	395	613	400	440	728	1830	225	150	105	450	169
8	260	376	866	400	420	996	1290	220	145	105	250	135
9	245	360	1590	400	430	1520	887	295	145	105	210	130
10	250	335	1430	400	440	1820	686	428	150	100	200	120
11	290	321	1160	420	430	1450	610	244	280	105	190	116
12	260	317	1210	430	420	1340	547	221	150	100	185	159
13	255	307	1030	420	420	1800	511	215	140	100	200	211
14	250	301	859	360	420	1760	516	210	135	100	170	132
15	235	287	2390	360	670	1320	509	230	130	100	150	115
16	220	285	3450	390	644	982	496	633	130	120	150	111
17	250	322	2550	592	565	837	472	387	130	2060	250	115
18	275	504	1590	1120	617	813	586	370	120	702	820	125
19	280	374	1150	712	596	837	504	300	115	300	350	150
20	330	343	2350	787	685	782	473	300	115	220	200	315
21	430	315	2850	739	558	695	469	300	120	180	150	205
22	290	291	2340	568	700	638	431	280	120	170	140	155
23	395	301	1560	478	1480	597	490	255	120	600	320	1960
24	574	308	1190	455	1040	674	470	240	115	300	275	940
25	721	1440	1220	442	818	780	427	210	115	200	180	415
26	454	2230	992	409	666	844	405	195	100	570	140	306
27	1050	1720	877	384	558	814	385	190	100	270	135	250
28	978	1260	782	371	497	716	383	180	100	220	175	235
29	648	1490	759	378	546	722	331	170	100	200	140	225
30	497	1360	650	414	---	672	362	165	105	180	125	205
31	430	---	662	620	---	650	---	165	---	230	120	---
TOTAL	11767	18512	42304	15575	17960	28793	19216	8230	4578	8048	8505	8654
MEAN	380	617	1365	502	619	929	641	265	153	260	274	288
MAX	1050	2230	3450	1120	1480	1820	1830	633	533	2060	1100	1960
MIN	220	285	613	360	420	589	331	165	100	94	120	111
CFSM	.52	.84	1.86	.68	.84	1.27	.87	.36	.21	.35	.37	.39
IN.	.60	.94	2.14	.79	.91	1.46	.97	.42	.23	.41	.43	.44

CAL YR 1987 TOTAL 208275 MEAN 571 MAX 3450 MIN 140 CFSM .78 IN 10.56
WTR YR 1988 TOTAL 192142 MEAN 525 MAX 3450 MIN 94 CFSM .72 IN 9.74

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1969, 1973 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Aug. 13, 1975 to Sept. 6, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at bridge. Daily-mean discharge is reported at sample time.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-76, 1978-81): Maximum, 3,580 microsiemens, Jan. 26, 1978; minimum, 126 microsiemens, July 29, 1976.
WATER TEMPERATURE (water years 1975-81): Maximum, 29.5°C, Sept. 20, 1978; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
DEC										
09...	1030	1590	721	8.1	7.0	37	10.5	89	E3300	E2600
MAR										
29...	1100	722	871	8.2	7.0	2.2	12.4	105	660	940
JUN										
07...	1100	150	--	8.2	23.0	4.6	6.4	77	K200	E220
SEP										
14...	1200	132	779	8.1	18.0	10	7.3	79	2800	230

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
DEC										
09...	240	--	68	17	49	30	1	4.6	--	--
MAR										
29...	290	86	80	23	73	35	2	3.4	254	0
JUN										
07...	280	84	75	23	82	38	2	6.2	242	0
SEP										
14...	220	72	60	17	69	40	2	6.8	181	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
DEC									
09...	--	54	93	0.30	6.3	412	0.56	1770	0.030
MAR									
29...	208	58	130	0.30	3.6	518	0.70	1010	0.020
JUN									
07...	198	58	130	0.50	6.5	553	0.75	224	0.100
SEP									
14...	148	63	100	0.50	6.1	441	0.60	157	0.020

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)
DEC 09...	1.90	0.120	0.100	0.80	0.210	0.070	0.040	40	1	43
MAR 29...	1.70	0.160	0.150	0.80	0.100	0.070	0.040	10	1	45
JUN 07...	4.30	0.170	0.170	1.6	0.250	0.180	0.130	20	2	52
SEP 14...	2.80	0.080	0.080	0.70	0.270	0.200	0.150	20	2	44

DATE	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)
DEC 09...	<0.5	<1	1	<3	2	39	<5	6	30	<0.1
MAR 29...	<0.5	<1	2	<3	1	11	<5	14	51	<0.1
JUN 07...	<0.5	<1	<1	<3	4	7	<5	13	65	<0.1
SEP 14...	<0.5	2	1	<3	3	13	<5	8	35	<0.1

DATE	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
DEC 09...	<10	7	<1	<1.0	210	<6	22	100	429	97
MAR 29...	<10	4	<1	1.0	220	<6	10	17	33	88
JUN 07...	20	21	<1	1.0	250	<6	9	11	4.5	--
SEP 14...	30	24	<1	<1.0	210	<6	20	20	7.1	--

04166000 RIVER ROUGE AT BIRMINGHAM, MI

LOCATION.--Lat 42°32'45", long 83°13'25", in NW1/4 sec.36, T.2 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on left bank 25 ft downstream from mouth of Quarton Lake outlet, and 100 ft upstream from bridge on Maple Road at Birmingham.

DRAINAGE AREA.--33.3 mi^2. Prior to water year 1971, drainage area was 36.9 mi^2. An area of 3.6 mi^2 noncontributing since then.

PERIOD OF RECORD.--June 1950 to current year.

REVISED RECORDS.--WSP 1387: 1951-52(M). WSP 1557: Drainage area.

GAGE.--Water-stage recorder. Concrete control since July 27, 1962. Datum of gage is 715.94 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Oct. 1-26, Jan. 25-28, Feb. 4-13, and July 7 to Aug. 19. Records good except for estimated daily discharges, which are poor. Occasional regulation by Quarton Lake upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--20 years (water years 1951-70), 15.3 ft^3/s, 5.63 in/yr; 18 years (water years 1971-88), 22.9 ft^3/s, 9.34 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,390 ft^3/s, June 26, 1968, gage height, 8.70 ft; minimum, 0.10 ft^3/s, Aug. 8, 9, 1963; minimum gage height, 1.02 ft, Oct. 12, 1961.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 180 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Nov. 25	1700	196	3.36	Dec. 20	1100	226	3.49
Dec. 15	1700	*359	*4.23				

Minimum daily discharge, 3.3 ft^3/s, July 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	25	43	27	49	20	16	13	7.5	4.8	8.6	5.5
2	11	21	34	24	35	24	16	12	23	5.0	7.0	5.8
3	9.5	14	30	24	27	31	26	11	13	5.1	9.4	10
4	8.6	12	35	23	23	22	51	11	8.8	5.0	8.0	22
5	8.6	11	29	20	21	21	29	11	7.6	5.1	15	60
6	18	9.0	26	18	19	23	36	9.9	7.3	4.7	64	17
7	12	8.5	26	19	19	29	68	11	6.5	4.0	17	11
8	10	8.7	52	20	18	36	36	9.8	6.2	3.6	10	9.0
9	9.2	10	80	20	18	49	28	20	5.9	3.4	8.4	8.2
10	9.0	10	46	19	17	38	23	19	5.2	3.7	8.0	7.5
11	11	9.4	35	19	17	30	21	12	5.0	4.1	6.8	6.9
12	9.5	9.7	44	20	17	44	20	10	5.8	3.8	6.2	14
13	8.8	9.1	33	21	17	51	19	9.9	5.9	3.7	6.1	17
14	8.2	8.6	28	18	18	35	21	9.1	5.8	3.5	6.0	9.3
15	8.0	8.5	183	18	32	29	20	12	5.2	3.3	5.8	6.1
16	7.6	8.7	113	18	28	25	18	30	5.1	3.9	6.3	6.5
17	9.0	15	60	41	25	23	17	14	5.1	98	7.6	6.4
18	9.8	23	43	75	26	24	20	11	4.9	25	20	6.2
19	8.4	12	45	33	25	24	17	9.9	5.0	15	12	8.4
20	10	11	162	47	23	22	16	9.8	5.0	10	8.8	20
21	13	9.2	81	36	19	20	19	9.9	5.0	8.4	7.2	12
22	11	8.8	52	26	28	16	16	9.5	4.8	7.4	6.5	12
23	13	9.5	42	23	45	16	21	9.2	4.5	26	20	101
24	27	9.7	41	22	29	19	18	9.6	4.2	20	17	25
25	28	109	43	20	23	21	16	8.1	5.0	12	9.4	14
26	15	62	35	19	20	21	15	8.0	4.6	27	7.7	11
27	60	31	32	18	20	19	15	7.5	4.8	12	6.9	9.4
28	23	25	32	18	19	18	17	6.9	5.2	9.4	8.2	7.7
29	15	60	31	19	20	20	17	6.7	4.9	8.0	6.3	7.2
30	12	40	27	28	---	20	14	6.5	5.1	15	6.5	6.7
31	9.5	---	29	42	---	17	---	7.5	---	28	6.1	---
TOTAL	427.7	608.4	1597	795	697	807	686	344.8	191.9	387.9	343.3	462.8
MEAN	13.8	20.3	51.5	25.6	24.0	26.0	22.9	11.1	6.40	12.5	11.1	15.4
MAX	60	109	183	75	49	51	68	30	23	98	64	101
MIN	7.6	8.5	26	18	17	16	14	6.5	4.2	3.3	5.8	5.5
CFSM	.41	.61	1.55	.77	.72	.78	.69	.33	.19	.38	.33	.46
IN.	.48	.68	1.78	.89	.78	.90	.77	.39	.21	.43	.38	.52

CAL YR 1987 TOTAL 8116.6 MEAN 22.2 MAX 183 MIN 4.5 CFSM .67 IN 9.07
WTR YR 1988 TOTAL 7348.8 MEAN 20.1 MAX 183 MIN 3.3 CFSM .60 IN 8.21

04166100 RIVER ROUGE AT SOUTHFIELD, MI

LOCATION.--Lat 42°26'52", long 83°17'52", in SW1/4 sec.32, T.1 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on right bank at downstream side of bridge on Beech Road at Southfield, 4.2 mi east of Farmington.

DRAINAGE AREA.--87.9 mi^2.

PERIOD OF RECORD.--April 1958 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 609.62 ft, City of Southfield datum. Prior to Sept. 30, 1958, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 1 to Mar. 6. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 62.7 ft^3/s, 9.69 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,900 ft^3/s, June 26, 1968, gage height, 19.04 ft; minimum, 0.1 ft^3/s, Aug. 2, 1964, gage height, 1.15 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 700 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 15	2000	*1,320	*11.41	July 17	1300	773	9.57
Dec. 20	1700	911	10.05	Sept. 23	1000	783	9.55

Minimum discharge, 8.3 ft^3/s, July 9, 15, gage height, 2.53 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	49	81	117	78	150	67	51	37	19	12	23	14
2	36	77	107	70	100	77	49	35	76	11	18	12
3	31	53	88	65	76	95	79	33	40	11	25	39
4	28	45	102	57	70	66	225	33	24	12	21	58
5	28	40	79	50	65	62	101	31	22	11	33	164
6	59	37	69	44	60	68	99	31	20	11	200	45
7	38	34	67	40	57	93	275	29	18	9.8	50	27
8	32	33	148	42	55	125	116	30	17	9.3	28	22
9	30	35	299	44	53	175	83	69	17	8.6	22	18
10	29	33	148	44	51	120	71	79	16	9.1	21	17
11	37	32	97	42	50	94	63	41	15	11	18	15
12	31	31	131	43	50	151	59	34	15	10	16	49
13	28	32	91	45	50	176	55	32	15	9.7	16	45
14	27	31	75	46	54	110	60	30	15	9.4	16	25
15	26	29	652	44	95	88	56	39	14	8.6	15	17
16	25	29	666	48	86	77	51	115	14	10	15	15
17	29	38	187	90	80	69	48	64	13	479	18	16
18	32	84	127	290	78	71	54	39	13	78	61	16
19	27	43	122	120	75	71	47	34	13	37	38	21
20	33	35	668	150	68	64	43	36	12	25	21	71
21	42	32	327	120	60	57	49	32	12	22	17	36
22	37	29	159	80	80	53	44	30	12	19	15	28
23	45	31	128	70	130	51	60	36	12	80	59	483
24	90	32	128	65	90	60	48	37	11	57	46	85
25	91	324	171	61	70	63	41	27	11	31	24	45
26	48	318	111	57	62	62	41	24	12	86	17	34
27	187	94	95	55	58	56	40	24	11	33	15	29
28	92	74	92	54	57	53	52	21	12	25	27	25
29	55	196	93	56	56	91	44	20	13	21	17	22
30	45	132	87	60	---	66	40	20	12	38	15	21
31	39	---	92	110	---	57	---	20	---	86	14	---
TOTAL	1426	2114	5523	2240	2086	2588	2144	1162	526	1280.5	941	1514
MEAN	46.0	70.5	178	72.3	71.9	83.5	71.5	37.5	17.5	41.3	30.4	50.5
MAX	187	324	668	290	150	176	275	115	76	479	200	483
MIN	25	29	67	40	50	51	40	20	11	8.6	14	12
CFSM	.52	.80	2.03	.82	.82	.95	.81	.43	.20	.47	.35	.58
IN.	.60	.89	2.34	.95	.88	1.10	.91	.49	.22	.54	.40	.64

CAL YR 1987 TOTAL 25701.0 MEAN 70.4 MAX 668 MIN 14 CFSM .80 IN 10.88
WTR YR 1988 TOTAL 23544.5 MEAN 64.3 MAX 668 MIN 8.6 CFSM .73 IN 9.96

04166200 EVANS DITCH AT SOUTHFIELD, MI

LOCATION.--Lat 42°27'28", long 83°16'03", in SE1/4 sec.28, T.1 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on right bank 70 ft upstream from bridge on Nine Mile Road at Southfield, 1.6 mi upstream from mouth, and 5.5 mi east of Farmington.

DRAINAGE AREA.--9.49 mi^2.

PERIOD OF RECORD.--September 1958 to current year.

GAGE.--Water-stage recorder. Datum of gage is 615.07 ft, City of Southfield datum.

REMARKS.--Estimated daily discharges: Dec. 15 to Jan. 16, Jan. 23-31, Feb. 3-14, 17-21, and Sept. 27-30. Records fair except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 8.48 ft^3/s, 12.13 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,200 ft^3/s, Oct. 1, 1981, gage height, 15.03 ft, from floodmarks, from rating curve extended above 410 ft^3/s; no flow June 13-15, 1986, caused by regulation of unknown source.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 330 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 15	1330	*579	*10.63	July 30	2230	435	9.76
July 17	0700	386	9.39	Sept. 23	0330	459	9.92

Minimum daily discharge, 0.84 ft^3/s, Aug. 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.9	18	16	6.2	18	7.1	4.7	3.1	2.1	1.3	2.6	.95
2	2.5	4.5	8.4	5.2	9.6	13	5.3	3.0	24	1.4	2.4	1.1
3	2.5	3.4	13	4.4	6.0	10	35	2.8	2.0	1.4	2.2	15
4	2.1	3.2	13	3.7	5.0	6.2	19	2.8	1.5	1.4	2.0	25
5	4.2	2.7	6.8	3.2	4.5	6.1	7.6	2.7	1.4	1.4	15	8.0
6	11	2.4	5.4	2.9	4.2	7.3	29	2.7	1.4	1.8	8.5	1.4
7	2.7	2.3	7.7	2.8	3.9	9.1	27	2.6	1.8	1.3	1.9	1.2
8	2.4	2.5	28	2.7	3.8	12	9.1	2.7	1.6	1.1	1.6	1.1
9	3.0	3.7	54	2.6	3.7	15	6.7	28	1.3	1.1	2.4	1.2
10	2.4	2.1	12	2.6	3.6	8.8	5.9	9.0	1.2	1.1	2.2	1.1
11	5.3	2.1	12	2.7	3.5	7.5	5.2	3.3	1.2	1.2	1.7	1.1
12	2.2	2.0	15	2.7	3.5	28	4.8	2.6	1.2	.88	1.4	7.9
13	2.1	2.0	7.0	3.4	3.5	15	4.5	2.6	1.2	.92	1.4	2.3
14	2.2	1.8	5.9	2.7	3.6	10	6.3	2.1	1.3	1.0	1.3	1.7
15	2.0	1.7	180	2.5	19	7.6	4.5	26	1.3	1.1	1.3	1.6
16	2.0	1.8	40	2.7	7.5	6.5	4.2	17	1.5	4.7	2.7	1.3
17	4.8	10	15	52	7.2	6.1	4.2	5.9	1.3	108	1.7	1.8
18	2.3	5.0	10	34	6.8	7.1	6.2	4.5	1.3	2.9	8.8	2.7
19	1.9	1.9	70	6.8	6.2	6.1	3.8	3.1	1.3	2.3	2.1	4.6
20	5.8	1.7	82	20	5.6	5.2	3.8	3.8	1.3	1.8	1.2	22
21	5.4	1.4	20	7.6	5.1	4.6	4.9	2.9	1.3	1.7	1.2	2.4
22	4.1	1.4	12	5.2	26	4.4	3.5	2.6	1.5	1.9	1.0	15
23	4.9	1.9	10	4.5	23	4.8	9.5	4.4	1.5	3.5	17	111
24	31	1.7	48	4.1	9.4	7.6	3.8	2.6	1.5	3.2	1.9	4.8
25	6.2	112	22	3.8	6.2	8.0	3.4	2.1	1.4	2.0	1.2	3.2
26	3.3	13	10	3.3	5.4	5.8	3.8	2.0	1.5	13	.89	2.8
27	54	6.5	9.0	3.1	5.5	4.9	4.1	2.0	1.4	1.4	.92	2.5
28	5.0	5.8	8.2	2.9	5.8	9.5	6.1	2.2	1.7	2.1	4.5	2.4
29	3.4	44	7.5	2.8	7.3	12	3.7	2.5	1.4	1.2	.84	2.2
30	2.8	14	7.0	5.0	---	7.3	3.4	2.5	1.3	61	.94	2.0
31	2.5	---	7.2	13	---	5.1	---	2.2	---	19	1.1	---
TOTAL	189.9	276.5	762.1	221.1	222.4	267.7	243.0	158.3	65.7	248.10	95.89	251.35
MEAN	6.13	9.22	24.6	7.13	7.67	8.64	8.10	5.11	2.19	8.00	3.09	8.38
MAX	54	112	180	52	26	28	35	28	24	108	17	111
MIN	1.9	1.4	5.4	2.5	3.5	4.4	3.4	2.0	1.2	.88	.84	.95
CFSM	.65	.97	2.59	.75	.81	.91	.85	.54	.23	.84	.33	.88
IN.	.74	1.08	2.99	.87	.87	1.05	.95	.62	.26	.97	.38	.99

CAL YR 1987 TOTAL 3619.30 MEAN 9.92 MAX 180 MIN 1.4 CFSM 1.05 IN 14.19
WTR YR 1988 TOTAL 3002.04 MEAN 8.20 MAX 180 MIN .84 CFSM .86 IN 11.77

04166300 UPPER RIVER ROUGE AT FARMINGTON, MI

LOCATION.--Lat 42°27'52", long 83°22'11", in NW1/4 sec.27, T.1 N., R.9 E., Oakland County, Hydrologic Unit 04090004, on left bank 800 ft downstream from bridge on Shiawassee Road at Farmington.

DRAINAGE AREA.--17.5 mi².

PERIOD OF RECORD.--March 1958 to current year.

REVISED RECORDS.--WSP 1912: 1959(M), 1960(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 690.4 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Jan. 2 to Feb. 28 and Mar. 3-6. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 12.2 ft³/s, 9.47 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft³/s, June 25, 1968, gage height, 8.70 ft; minimum, 0.07 ft³/s, Aug. 30, 1966, result of regulation; minimum daily, 0.32 ft³/s, Aug. 10, 1964, Aug. 29, 1966.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 15	1600	*176	*4.37	Sept. 23	0600	124	4.08
Dec. 20	1000	128	4.09				

Minimum discharge, 1.6 ft³/s, July 7, Aug. 22, gage height, 2.79 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.4	13	22	14	27	12	12	8.1	4.6	2.4	13	2.6
2	4.9	12	19	12	20	16	11	7.8	10	2.5	8.4	2.4
3	4.4	9.2	16	11	15	19	26	7.4	6.5	2.4	7.4	4.2
4	3.5	7.9	16	10	13	13	71	7.4	5.3	2.2	4.7	14
5	3.7	6.6	13	9.0	11	13	31	7.0	4.5	2.1	6.6	46
6	6.3	5.8	10	7.7	10	14	33	7.3	4.3	2.1	19	22
7	5.1	6.0	11	7.2	10	22	67	7.2	3.9	2.0	12	9.1
8	4.8	5.4	28	7.1	9.7	31	33	7.0	3.6	2.0	7.6	6.4
9	4.6	6.1	50	7.4	9.2	46	23	8.3	3.7	2.0	6.0	4.7
10	4.7	5.8	29	7.5	8.8	32	18	9.1	3.8	2.3	5.3	3.8
11	5.4	5.6	21	7.4	8.6	25	15	8.2	3.6	2.6	5.0	3.5
12	4.7	5.4	23	7.2	8.5	36	13	7.7	3.7	2.1	4.5	12
13	5.3	5.4	16	8.0	8.4	45	12	7.1	3.7	2.1	4.5	8.2
14	4.5	5.5	13	7.6	9.0	28	14	7.0	3.0	2.1	4.2	6.5
15	4.2	5.5	96	7.4	18	22	13	9.2	2.8	2.0	3.8	4.8
16	3.8	5.8	76	7.8	16	18	12	16	2.8	5.3	3.3	3.8
17	4.5	6.9	34	25	15	15	11	12	2.8	77	4.1	3.5
18	4.1	11	23	54	15	17	11	8.5	2.9	27	8.6	3.6
19	3.9	8.5	23	37	14	16	9.9	7.4	3.0	11	7.3	4.9
20	5.1	7.0	99	42	12	13	9.5	7.3	3.4	7.6	4.5	15
21	6.4	6.7	55	25	11	12	9.9	7.3	3.4	6.1	3.1	10
22	7.2	5.8	31	16	18	11	9.3	7.2	3.3	5.3	2.0	11
23	7.8	5.8	23	12	25	11	11	7.2	2.8	5.9	8.5	88
24	17	5.8	23	10	18	13	9.8	7.0	2.7	5.5	8.2	32
25	18	59	28	9.0	13	15	9.0	6.4	2.7	5.5	6.5	13
26	11	53	20	8.8	11	15	8.6	6.2	2.7	14	4.8	8.1
27	30	21	15	8.6	10	13	8.7	5.6	2.8	8.6	3.9	6.8
28	20	14	14	8.4	9.7	13	10	4.9	3.0	8.8	4.1	5.7
29	12	33	13	8.7	11	18	9.4	5.4	3.0	6.1	2.5	5.1
30	8.8	25	18	10	---	16	8.8	4.9	2.7	10	3.3	4.7
31	6.9	---	16	15	---	14	---	4.7	---	35	2.9	---
TOTAL	238.0	373.5	894	427.8	384.9	604	539.9	233.8	111.0	271.6	189.6	365.4
MEAN	7.68	12.5	28.8	13.8	13.3	19.5	18.0	7.54	3.70	8.76	6.12	12.2
MAX	30	59	99	54	27	46	71	16	10	77	19	88
MIN	3.5	5.4	10	7.1	8.4	11	8.6	4.7	2.7	2.0	2.0	2.4
CFSM	.44	.71	1.65	.79	.76	1.11	1.03	.43	.21	.50	.35	.70
IN.	.51	.79	1.90	.91	.82	1.28	1.15	.50	.24	.58	.40	.78

CAL YR 1987 TOTAL 4991.6 MEAN 13.7 MAX 118 MIN 2.6 CFSM .78 IN 10.61
WTR YR 1988 TOTAL 4633.5 MEAN 12.7 MAX 99 MIN 2.0 CFSM .73 IN 9.85

04166500 RIVER ROUGE AT DETROIT, MI

LOCATION.--Lat 42°22'20", long 83°15'20", in SW1/4 sec.27, T.1 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 500 ft upstream from bridge on Plymouth Road at Detroit, 4 mi upstream from Middle River Rouge.

DRAINAGE AREA.--187 mi^2.

PERIOD OF RECORD.--October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1034: 1933(M). WSP 1054: 1939, 1943, 1945(M). WSP 1437: 1931-32, 1934, 1936(M), 1937-38, 1944(M), 1945. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 584.00 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 16, 1948, nonrecording gage at site 1 mi downstream at datum 4.6 ft lower.

REMARKS.--Estimated daily discharges: Jan. 1 to Feb. 27, July 16 to Aug. 15, and Aug. 17-23. Records good except for period of estimated daily discharges, Jan. 1 to Feb. 27, which is fair and periods of estimated daily discharges, July 16 to Aug. 15 and Aug. 17-23, which are poor. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--58 years, 117 ft^3/s, 8.50 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,000 ft^3/s, Apr. 5, 1947; maximum gage height, 23.0 ft, Apr. 6, 1947, from floodmark, site and datum then in use; minimum discharge, 1.8 ft^3/s, Aug. 1, 2, 1964, gage height, 3.00 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 16	0900	*1,790	*13.48	No other peak greater than base discharge.			

Minimum daily discharge, 12 ft^3/s, July 9, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	93	137	196	120	230	123	91	67	35	19	40	23
2	61	154	196	100	190	116	87	62	145	18	33	23
3	51	93	154	92	120	216	131	60	92	16	45	59
4	44	73	198	85	110	120	465	58	49	18	37	171
5	43	64	136	80	100	109	216	59	42	16	60	308
6	107	58	112	72	95	115	172	56	38	16	400	113
7	63	51	101	66	90	139	565	55	35	14	85	57
8	52	51	218	68	87	181	249	56	33	15	50	39
9	45	54	543	70	84	273	162	109	32	12	40	31
10	47	51	349	70	82	224	131	208	28	13	35	30
11	59	50	177	68	80	163	114	82	28	14	31	26
12	53	46	232	70	80	211	103	65	27	16	29	85
13	43	48	155	74	80	353	97	62	26	15	29	126
14	41	47	124	72	85	202	106	56	25	12	29	50
15	39	44	746	70	150	158	104	72	24	13	27	35
16	38	43	1550	74	140	135	91	262	24	15	29	28
17	46	58	456	130	130	115	82	119	22	900	45	25
18	50	156	223	350	125	117	97	75	24	120	120	40
19	43	78	194	160	120	120	85	65	22	60	60	50
20	43	59	706	260	110	108	76	69	21	45	40	157
21	70	50	783	150	95	92	83	63	18	40	30	73
22	60	46	278	120	140	85	76	63	18	35	27	70
23	78	48	214	105	210	83	108	59	22	150	120	924
24	168	49	202	96	150	115	96	75	16	100	111	276
25	236	448	332	90	110	112	73	53	16	55	46	93
26	93	784	202	80	96	115	71	47	18	160	31	63
27	360	201	154	74	92	97	70	44	19	60	27	51
28	216	133	139	74	90	93	101	42	16	45	57	44
29	104	366	139	76	114	200	83	40	21	40	36	39
30	77	265	106	85	---	125	72	38	19	70	25	36
31	64	---	136	150	---	105	---	38	---	160	24	---
TOTAL	2587	3805	9451	3251	3385	4520	4057	2279	955	2282	1798	3145
MEAN	83.5	127	305	105	117	146	135	73.5	31.8	73.6	58.0	105
MAX	360	784	1550	350	230	353	565	262	145	900	400	924
MIN	38	43	101	66	80	83	70	38	16	12	24	23
CFSM	.45	.68	1.63	.56	.63	.78	.72	.39	.17	.39	.31	.56
IN.	.51	.76	1.88	.65	.67	.90	.81	.45	.19	.45	.36	.63

CAL YR 1987 TOTAL 47725 MEAN 131 MAX 1550 MIN 22 CFSM .70 IN 9.49
WTR YR 1988 TOTAL 41515 MEAN 113 MAX 1550 MIN 12 CFSM .60 IN 8.26

04167000 MIDDLE RIVER ROUGE NEAR GARDEN CITY, MI

LOCATION.--Lat 42°20'55", long 83°18'45", in SW1/4 NW1/4 sec.6, T.2 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 200 ft downstream from bridge on Inkster Road, 1.8 mi northeast of Garden City, and 6.0 mi upstream from mouth.

DRAINAGE AREA.--99.9 mi².

PERIOD OF RECORD.--October 1930 to September 1933 (published as "at Detroit"), June 1947 to September 1977, October 1977 to September 1983 (operated as a crest-stage partial-record station only), October 1983 to current year. Monthly discharge only for October, November, 1930, published in WSP 1307.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 600.95 ft above National Geodetic Vertical Datum of 1929. Nov. 21, 1930 to Sept. 30, 1933, nonrecording gage at site 4.8 mi downstream at datum 17.48 ft lower. June 6, 1947 to Oct. 18, 1948, nonrecording gage at site 200 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Jan. 4-15, 23-30, and Feb. 3-14, 18-25. Records good except for estimated daily discharges, which are fair. Occasional regulation by reservoirs upstream from station since 1956. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--38 years (water years 1931-33, 1948-77, 1984-88), 71.5 ft³/s, 9.72 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,330 ft³/s, June 26, 1968; maximum gage height, 10.50 ft, May 10, 1948; minimum discharge, 0.9 ft³/s, Aug. 16, 1956.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 700 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 16	0400	*802	*8.24	No other peak greater than base discharge.			

Minimum discharge, 14 ft³/s, July 5, gage height, 1.69 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	64	97	138	82	170	93	88	50	27	17	53	19
2	44	68	116	78	179	95	80	48	65	17	32	18
3	38	53	108	69	100	139	115	46	34	17	25	53
4	35	45	116	60	85	112	245	45	27	17	23	159
5	40	40	82	55	76	96	204	45	23	15	37	96
6	62	35	68	50	70	92	173	44	22	15	77	44
7	43	33	66	46	64	102	283	43	21	16	43	30
8	37	32	123	44	60	126	224	42	21	16	30	25
9	36	35	252	45	57	176	152	93	20	16	25	23
10	35	31	178	47	55	185	113	94	21	16	32	20
11	44	29	127	46	54	144	95	54	21	17	37	18
12	38	29	134	47	53	165	83	46	21	17	25	72
13	34	29	99	50	53	199	76	45	21	16	21	66
14	32	29	81	48	54	176	80	41	20	16	19	33
15	32	27	501	46	112	130	74	64	20	16	133	24
16	31	27	571	48	96	107	69	123	20	26	45	21
17	39	43	267	122	92	93	64	74	19	402	32	19
18	36	65	167	260	90	91	70	55	19	156	80	67
19	33	43	151	160	85	92	61	47	19	60	56	58
20	37	37	395	162	80	86	57	49	19	38	31	109
21	40	33	343	168	76	77	57	43	19	33	24	51
22	43	31	224	113	110	70	54	40	18	33	19	58
23	43	35	161	80	150	68	73	47	20	34	58	372
24	107	36	160	70	120	114	60	46	17	35	49	143
25	96	294	213	65	95	106	53	37	17	35	33	64
26	51	287	156	60	86	98	52	33	17	52	24	44
27	181	138	124	55	86	89	53	32	16	39	21	36
28	91	94	107	54	76	94	72	31	18	46	51	30
29	60	206	102	56	84	163	59	30	18	27	27	27
30	46	145	84	64	---	122	54	30	18	48	22	27
31	38	---	86	99	---	102	---	29	---	114	20	---
TOTAL	1586	2126	5500	2457	2568	3602	2993	1546	658	1422	1204	1826
MEAN	51.2	70.9	177	79.3	88.6	116	99.8	49.9	21.9	45.9	38.8	60.9
MAX	181	294	571	260	179	199	283	123	65	402	133	372
MIN	31	27	66	44	53	68	52	29	16	15	19	18
CFSM	.51	.71	1.77	.79	.89	1.16	1.00	.50	.22	.46	.39	.61
IN.	.59	.79	2.05	.91	.96	1.34	1.11	.58	.25	.53	.45	.68

CAL YR 1987 TOTAL 29245 MEAN 80.1 MAX 600 MIN 19 CFSM .80 IN 10.89
WTR YR 1988 TOTAL 27488 MEAN 75.1 MAX 571 MIN 15 CFSM .75 IN 10.24

04168000 LOWER RIVER ROUGE AT INKSTER, MI

LOCATION.--Lat 42°18'00", long 83°18'00", in SW1/4 SE1/4 sec.19, T.2 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 10 ft downstream from bridge on John Daly Road, 0.6 mi northeast of Inkster, and 4.8 mi upstream from mouth.

DRAINAGE AREA.--83.2 mi².

PERIOD OF RECORD.--June 1947 to current year.

REVISED RECORDS.--WSP 1174: 1948(M). WSP 1437: 1949. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 593.14 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 20, 1948, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 2 to Feb. 28, Mar. 3-5, June 14-16, and July 26, 27. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--41 years, 53.2 ft³/s, 8.68 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,600 ft³/s, June 26, 1968, gage height, 13.62 ft; minimum, 0.2 ft³/s, Sept. 13, 1955, Jan. 23, 1961.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 16	1600	*977	*9.42	No other peak greater than base discharge.			

Minimum discharge, 0.99 ft³/s, July 8, 9, 30, Aug. 5, Sept. 12, gage height, 2.56 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	18	64	129	50	190	93	57	22	3.5	2.1	10	2.0
2	9.3	75	128	45	160	88	54	21	18	1.7	4.8	2.2
3	8.0	47	91	35	69	150	60	19	8.0	1.7	5.0	15
4	7.6	34	101	29	48	80	221	18	4.7	1.7	5.6	60
5	9.1	25	76	26	44	60	131	17	3.9	1.7	18	20
6	21	19	59	23	39	63	105	16	3.2	1.4	28	8.7
7	12	16	52	21	36	82	240	16	2.1	1.4	6.9	4.8
8	9.0	14	129	21	33	112	144	16	3.2	1.3	3.9	6.8
9	8.4	14	360	21	32	185	90	35	2.6	1.2	2.4	4.6
10	8.8	12	255	21	31	149	70	36	2.1	1.5	8.9	1.7
11	14	11	126	20	30	108	59	24	2.0	2.1	8.2	1.2
12	10	10	140	21	30	114	51	18	2.0	2.4	3.2	23
13	8.6	15	99	22	30	201	46	15	2.0	2.1	3.2	16
14	8.0	11	66	21	32	112	48	14	1.9	1.9	1.6	5.3
15	8.9	8.8	473	20	70	76	42	30	1.8	2.0	53	2.8
16	8.9	8.2	841	21	65	65	38	57	1.7	4.6	12	2.3
17	18	13	256	60	60	55	36	24	1.7	104	7.7	1.5
18	11	23	129	260	58	56	38	14	1.5	14	46	35
19	8.3	15	99	110	54	58	33	16	2.4	7.8	20	26
20	10	13	372	140	50	49	33	24	2.4	5.9	11	52
21	13	11	418	150	40	40	38	14	1.5	2.9	5.4	16
22	13	9.2	157	56	75	36	28	15	2.3	2.1	3.0	22
23	17	9.2	107	40	160	37	40	15	14	1.8	14	145
24	50	9.1	106	34	120	66	33	11	3.9	4.2	11	43
25	51	226	248	31	77	97	27	7.7	2.5	4.7	4.3	16
26	29	329	153	27	55	88	24	6.2	2.8	10	2.7	9.4
27	109	117	91	25	50	64	24	5.8	2.4	4.2	2.2	6.4
28	80	74	70	24	45	53	29	5.0	2.1	5.6	12	4.2
29	37	211	62	22	62	113	27	4.5	2.3	2.4	4.6	3.4
30	25	169	51	35	---	99	25	3.9	2.2	11	2.0	3.0
31	19	---	56	100	---	72	---	3.7	---	37	1.6	---
TOTAL	660.7	1612.5	5500	1531	1845	2721	1891	543.8	106.7	248.4	330.2	559.3
MEAN	21.3	53.8	177	49.4	63.6	87.8	63.0	17.5	3.56	8.01	10.7	18.6
MAX	109	329	841	260	190	201	240	57	18	104	53	145
MIN	7.6	8.2	51	20	30	36	24	3.7	1.5	1.2	1.6	1.2
CFSM	.26	.65	2.13	.59	.76	1.06	.76	.21	.04	.10	.13	.22
IN.	.30	.72	2.46	.68	.82	1.22	.85	.24	.05	.11	.15	.25

CAL YR 1987 TOTAL 19204.6 MEAN 52.6 MAX 841 MIN 1.3 CFSM .63 IN 8.59
WTR YR 1988 TOTAL 17549.6 MEAN 47.9 MAX 841 MIN 1.2 CFSM .58 IN 7.85

04170000 HURON RIVER AT MILFORD, MI

LOCATION.--Lat 42°34'44", long 83°37'36", in NE1/4 sec.16, T.2 N., R.7 E., Oakland County, Hydrologic Unit 04090005, on left bank 40 ft downstream from bridge on General Motors Road, 0.5 mi downstream from Sherwood Creek, and 0.5 mi west of Milford.

DRAINAGE AREA.--132 mi^2.

PERIOD OF RECORD.--September 1948 to current year.

REVISED RECORDS.--WSP 1337: 1952(m). WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 880.00 ft above National Geodetic Vertical Datum of 1929. Prior to Apr. 1, 1970, at site 240 ft upstream at same datum.

REMARKS.--Estimated daily discharges: July 7 to Aug. 14 and Sept. 13-21. Records good except for estimated daily discharges, which are poor. Flow below about 300 ft^3/s regulated by powerplant 1.5 mi upstream from station prior to May 20, 1957; occasional regulation for lake level control since. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--40 years, 97.9 ft^3/s, 10.07 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 648 ft^3/s, Oct. 3, 1981, gage height, 7.87 ft; maximum gage height, 8.26 ft, June 28, 1968; minimum daily discharge, 5.2 ft^3/s, Oct. 21, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 195 ft^3/s, Dec. 21, gage height, 5.95 ft; minimum daily, 10 ft^3/s, July 13-15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	63	125	128	142	156	116	130	74	34	20	32	19
2	60	154	127	138	146	116	129	70	35	19	29	17
3	58	148	126	139	138	122	136	65	38	15	25	18
4	59	137	124	137	136	117	161	58	41	14	22	23
5	60	124	121	121	133	115	159	46	41	14	25	29
6	65	114	117	136	127	115	146	45	38	13	38	37
7	65	107	117	129	125	120	163	43	33	13	34	36
8	63	110	127	126	123	132	169	47	31	12	28	32
9	62	109	147	122	123	157	154	50	30	12	26	29
10	60	104	144	117	121	164	140	50	28	12	30	28
11	63	97	143	114	121	157	132	50	32	12	32	25
12	63	95	143	112	123	166	124	49	35	11	31	24
13	59	92	137	111	119	186	115	46	39	10	40	23
14	56	92	130	107	120	185	111	49	35	10	37	22
15	57	106	148	105	128	177	105	50	29	10	46	20
16	55	115	167	104	128	169	97	70	28	15	38	19
17	58	121	168	114	125	162	93	77	28	27	32	20
18	59	120	157	142	124	156	90	64	28	33	37	23
19	56	112	148	138	124	147	85	55	27	31	40	30
20	58	103	175	140	126	141	81	52	26	30	34	42
21	63	96	192	141	120	136	80	51	21	28	30	48
22	64	90	186	127	124	130	77	53	18	25	24	55
23	64	87	175	118	127	127	80	50	21	22	24	74
24	68	87	171	114	124	137	78	52	25	21	30	78
25	77	125	167	110	121	141	76	49	24	21	27	78
26	78	152	161	108	118	145	74	46	18	22	24	73
27	99	144	151	105	120	140	74	44	17	20	23	67
28	111	132	149	103	118	137	80	42	19	21	25	56
29	104	133	149	102	116	137	81	38	23	23	25	57
30	99	130	146	106	---	138	79	36	21	27	24	56
31	103	---	145	130	---	137	---	35	---	35	20	---
TOTAL	2129	3461	4586	3758	3654	4425	3299	1606	863	598	932	1158
MEAN	68.7	115	148	121	126	143	110	51.8	28.8	19.3	30.1	38.6
MAX	111	154	192	142	156	186	169	77	41	35	46	78
MIN	55	87	117	102	116	115	74	35	17	10	20	17
CFSM	.52	.87	1.12	.92	.96	1.08	.83	.39	.22	.15	.23	.29
IN.	.60	.98	1.29	1.06	1.03	1.25	.93	.45	.24	.17	.26	.33

CAL YR 1987 TOTAL 32842 MEAN 90.0 MAX 192 MIN 29 CFSM .68 IN 9.26
WTR YR 1988 TOTAL 30469 MEAN 83.2 MAX 192 MIN 10 CFSM .63 IN 8.59

04170490 KENT LAKE NEAR NEW HUDSON, MI

LOCATION.--Lat 42°30'45", long 83°40'34", in sec.1, T.1 N., R.6 E., Livingston County, Hydrologic Unit 04090005, at Kent Lake Dam, 2 mi upstream from Woodruff Creek, and 3 mi west of New Hudson.

DRAINAGE AREA.--148 mi².

PERIOD OF RECORD.--April 1949 to current year.

GAGE.--Water-stage recorder. Datum of gage is 868.00 ft above National Geodetic Vertical Datum of 1929 (Huron-Clinton Metropolitan Authority bench mark).

REMARKS.--The inlet and outlet is the Huron River which enters the northeast end of the lake and leaves the southwest end of the lake. Streamflow records are currently collected on the Huron River at sites about 1 mi upstream (04170000) and 150 ft downstream (04170500) from Kent Lake. Maximum depth 38 ft, surface area 1,200 acres. A concrete dam with steel drum spillway is used to control the lake level.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 16.68 ft, Apr. 6, 1950; minimum, 11.60 ft, Mar. 7, 8, 1968.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 15.79 ft, Nov. 2, 3; minimum recorded, 12.56 ft, occurred sometime during period Nov. 25 to Dec. 7 and may have been lower during same period.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15.55	15.76	---	12.65	12.73	12.64	12.81	14.56	15.31	---	15.43	15.40
2	15.55	15.78	---	12.64	12.76	12.64	12.80	14.63	---	---	15.43	15.39
3	15.55	15.78	---	12.64	12.75	12.65	12.83	14.69	---	---	15.41	15.40
4	15.53	15.73	---	12.64	12.74	12.64	12.92	14.71	---	---	15.39	15.42
5	15.53	15.58	---	12.65	12.72	12.63	13.06	14.71	---	15.24	15.39	15.46
6	15.56	15.48	---	12.66	12.70	12.63	13.15	14.69	---	15.24	15.45	15.45
7	15.57	15.43	12.65	12.67	12.68	12.64	13.27	14.68	---	15.23	15.44	15.46
8	15.56	15.40	12.67	12.69	12.69	12.65	13.41	14.67	---	15.23	15.42	15.45
9	15.55	15.35	12.69	12.71	12.70	12.70	13.51	14.69	---	15.23	15.40	15.45
10	15.56	15.13	12.73	12.72	12.71	12.75	13.55	14.72	---	15.23	15.41	15.44
11	15.57	14.86	12.73	12.74	12.71	12.76	13.59	14.73	---	15.24	15.42	15.44
12	15.56	14.68	12.72	12.72	12.72	12.78	13.72	14.73	---	15.24	15.42	15.43
13	15.56	14.37	12.72	12.64	12.72	12.81	13.80	14.78	---	15.23	15.45	15.44
14	15.55	14.10	12.71	12.62	12.73	12.84	13.85	14.83	---	15.22	15.43	15.42
15	15.55	---	12.67	12.63	12.70	12.84	13.88	14.88	---	15.21	15.46	15.42
16	15.54	---	12.70	12.62	12.69	12.82	13.88	14.97	---	15.22	15.44	15.41
17	15.55	---	12.71	12.63	12.69	12.81	13.85	15.04	---	15.40	15.43	15.40
18	15.56	---	12.71	12.69	12.68	12.79	13.89	15.13	---	15.43	15.47	15.42
19	15.56	---	12.69	12.72	12.68	12.77	13.97	15.18	---	15.44	15.45	15.45
20	15.56	---	12.72	12.73	12.69	12.75	14.01	15.20	---	15.43	15.43	15.49
21	15.56	---	12.73	12.73	12.67	12.73	14.06	15.22	---	15.43	15.42	15.52
22	15.56	---	12.76	12.72	12.67	12.70	14.08	15.23	---	15.42	15.39	15.53
23	15.57	---	12.75	12.69	12.67	12.68	14.09	15.24	---	15.40	15.41	15.63
24	15.59	---	12.74	12.67	12.67	12.69	14.18	15.24	---	15.39	15.42	15.63
25	15.60	---	12.73	12.65	12.67	12.69	14.22	15.26	---	15.39	15.41	15.62
26	15.62	---	12.72	12.64	12.66	12.70	14.27	15.29	---	15.39	15.41	15.61
27	15.69	---	12.69	12.63	12.65	12.70	14.32	15.31	---	15.38	15.40	15.60
28	15.71	---	12.69	12.61	12.65	12.70	14.41	15.33	---	15.39	15.42	15.59
29	15.72	---	12.70	12.60	12.64	12.69	14.48	15.34	---	15.39	15.42	15.56
30	15.71	---	12.68	12.61	---	12.73	14.54	15.33	---	15.41	15.42	15.54
31	15.71	---	12.66	12.65	---	12.81	---	15.32	---	15.44	15.40	---
MEAN	15.58	---	---	12.66	12.69	12.72	13.75	14.98	---	---	15.42	15.48
MAX	15.72	---	---	12.74	12.76	12.84	14.54	15.34	---	---	15.47	15.63
MIN	15.53	---	---	12.60	12.64	12.63	12.80	14.56	---	---	15.39	15.39

04170500 HURON RIVER NEAR NEW HUDSON, MI

LOCATION.--Lat 42°30'45", long 83°40'35", in NE1/4 sec.1, T.1 N., R.6 E., Livingston County, Hydrologic Unit 04090005, on right bank 150 ft downstream from Kent Lake Dam, 2 mi upstream from Woodruff Creek, and 3 mi west of New Hudson.

DRAINAGE AREA.--148 mi^2.

PERIOD OF RECORD.--August 1948 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 868.00 ft above National Geodetic Vertical Datum of 1929 (Huron-Clinton Metropolitan Authority bench mark).

REMARKS.--No estimated daily discharges. Records good. Occasional regulation by Kent Lake (see preceding page). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--40 years, 111 ft^3/s, 10.18 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,080 ft^3/s, Dec. 29, 1950, gage height, 5.05 ft, from rating curve extended above 600 ft^3/s; minimum, 2.6 ft^3/s, May 27, 1963, gage height, 0.53 ft; minimum daily, 6.4 ft^3/s, May 7, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 274 ft^3/s, Nov. 12, gage height, 2.69 ft; minimum daily, 11 ft^3/s, July 13-15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	59	129	157	165	163	135	138	44	42	20	36	19
2	60	138	150	161	174	135	139	24	46	19	34	16
3	58	139	153	159	169	137	150	33	44	19	29	20
4	54	177	150	159	167	137	125	41	43	17	25	27
5	55	177	144	152	162	134	131	38	45	16	25	43
6	63	143	142	152	155	133	156	36	42	15	43	36
7	65	125	140	151	151	135	114	33	39	14	40	37
8	63	120	145	151	148	140	111	32	42	14	33	35
9	60	166	153	150	148	154	136	35	39	14	29	35
10	64	215	164	146	146	165	144	42	34	14	33	31
11	65	191	165	144	148	167	103	43	35	14	36	30
12	64	201	165	143	150	175	63	28	35	13	35	27
13	63	233	163	143	145	186	86	12	37	11	45	29
14	59	197	160	139	144	193	102	18	39	11	42	25
15	59	153	169	138	149	190	108	25	37	11	56	23
16	57	188	179	138	150	185	106	46	39	12	47	21
17	60	186	182	143	148	179	97	31	36	30	38	19
18	61	204	181	159	147	174	72	22	32	34	51	24
19	62	209	178	167	148	168	42	31	30	37	45	30
20	64	212	188	170	151	163	54	38	28	34	34	47
21	64	196	196	171	145	155	68	43	27	34	28	54
22	65	153	202	165	144	149	74	48	26	30	22	59
23	69	131	199	158	145	143	50	55	27	28	28	104
24	74	123	194	152	145	148	40	38	25	24	32	101
25	79	146	192	147	144	150	50	20	25	24	29	96
26	80	159	187	144	141	153	44	25	25	25	26	91
27	103	161	180	139	139	152	35	30	23	22	24	83
28	111	159	180	135	137	154	36	36	22	23	31	82
29	114	156	179	132	137	152	39	40	22	25	29	66
30	111	155	172	132	---	140	50	40	22	28	25	60
31	111	---	168	144	---	135	---	41	---	39	22	---
TOTAL	2196	5042	5277	4649	4340	4816	2663	1068	1008	671	1052	1370
MEAN	70.8	168	170	150	150	155	88.8	34.5	33.6	21.6	33.9	45.7
MAX	114	233	202	171	174	193	156	55	46	39	56	104
MIN	54	120	140	132	137	133	35	12	22	11	22	16
CFSM	.48	1.14	1.15	1.01	1.01	1.05	.60	.23	.23	.15	.23	.31
IN.	.55	1.27	1.33	1.17	1.09	1.21	.67	.27	.25	.17	.26	.34

CAL YR 1987 TOTAL 35820 MEAN 98.1 MAX 233 MIN 28 CFSM .66 IN 9.00
WTR YR 1988 TOTAL 34152 MEAN 93.3 MAX 233 MIN 11 CFSM .63 IN 8.58

04172000 HURON RIVER NEAR HAMBURG, MI

LOCATION.--Lat 42°27'55", long 83°48'00", in sec.24, T.1 N., R.5 E., Livingston County, Hydrologic Unit 04090005, on right bank at downstream side of bridge on Hamburg Road, 1.1 mi north of Hamburg, and 3 mi upstream from Strawberry Lake.

DRAINAGE AREA.--308 mi².

PERIOD OF RECORD.--October 1951 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 850.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 12, 1953, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 31 to Jan. 15, Jan. 27-29, and Feb. 6-27. Records good except for estimated daily discharges, which are fair. Occasional regulation by Kent Lake (station 04170490), 11 mi upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--37 years, 212 ft³/s, 9.35 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,560 ft³/s, May 15, 1956; maximum gage height, 8.46 ft, June 30, 1968; minimum discharge, 26 ft³/s, July 15, 16, 1988; minimum gage height, 3.16 ft, Aug. 1-3, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 472 ft³/s, Apr. 10, gage height, 5.25 ft; minimum, 26 ft³/s, July 15, 16, gage height, 3.19 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	101	238	281	315	261	245	283	150	134	44	64	89
2	100	257	276	305	287	244	278	137	130	42	63	84
3	98	267	270	295	298	248	285	123	125	42	60	82
4	95	271	265	285	301	249	333	122	119	40	57	89
5	92	281	257	280	298	249	353	122	117	39	55	114
6	94	286	245	275	285	248	380	120	117	37	68	112
7	98	265	237	270	275	252	442	117	115	35	79	106
8	100	241	240	270	270	264	463	113	109	33	79	101
9	100	226	259	270	270	295	464	113	105	31	76	98
10	100	242	273	265	265	320	471	122	102	29	76	94
11	105	274	281	262	265	341	463	123	99	29	77	90
12	108	290	290	260	262	365	417	118	97	29	80	89
13	107	283	290	255	260	394	354	105	95	28	96	90
14	105	298	285	252	260	406	334	92	92	28	96	87
15	103	299	296	250	265	411	324	90	89	27	108	82
16	102	262	318	246	265	404	313	106	87	27	109	78
17	103	250	326	246	265	390	297	120	84	46	104	75
18	105	262	333	265	265	374	284	115	81	56	120	75
19	107	259	340	281	265	360	245	109	77	60	130	81
20	111	273	363	283	262	345	213	112	75	58	126	94
21	118	268	380	285	262	327	205	119	72	55	113	106
22	123	267	395	285	260	309	202	127	67	52	101	115
23	129	238	412	279	258	295	208	132	64	50	98	159
24	136	207	425	268	258	291	190	139	60	49	104	188
25	149	223	430	252	255	296	175	129	58	48	104	193
26	153	258	421	239	255	306	173	121	53	52	100	185
27	173	271	406	225	255	307	163	119	50	52	95	173
28	202	276	390	215	251	304	161	121	48	51	96	159
29	222	282	374	210	248	310	152	127	47	51	96	146
30	230	282	352	213	---	310	150	131	45	51	94	132
31	231	---	335	225	---	296	---	133	---	58	91	---
TOTAL	3900	7896	10045	8126	7736	9755	8775	3727	2613	1329	2815	3366
MEAN	126	263	324	262	267	315	293	120	87.1	42.9	90.8	112
MAX	231	299	430	315	301	411	471	150	134	60	130	193
MIN	92	207	237	210	248	244	150	90	45	27	55	75
CFSM	.41	.85	1.05	.85	.87	1.02	.95	.39	.28	.14	.30	.36
IN.	.47	.95	1.21	.98	.93	1.18	1.06	.45	.32	.16	.34	.41

CAL YR 1987 TOTAL 68001 MEAN 186 MAX 430 MIN 73 CFSM .60 IN 8.21
WTR YR 1988 TOTAL 70083 MEAN 191 MAX 471 MIN 27 CFSM .62 IN 8.46

04174050 HURON RIVER AT DELHI MILLS, MI

LOCATION.--Lat 42°20'01", long 83°48'34", in SE1/4 sec.2, T.2 S., R.5 E., Washtenaw County, Hydrologic Unit 04090005, at bridge on East Delhi Road, 5.0 mi northwest of Ann Arbor, 5.2 mi downstream from Mill Creek, 5.1 mi upstream from Barton Dam, and 60.0 mi upstream from mouth.

DRAINAGE AREA.--699 mi².

PERIOD OF RECORD.--Water years 1971-81, 1983 to current year.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	SPECIFIC CONDUCTANCE LAB (US/CM)	PH LAB (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	CARBON, ORGANIC TOTAL (MG/L AS C)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)
NOV											
27...	1445	675	8.00	5.5	9.5	<0.010	<0.1	<0.010	<0.010	<0.010	<0.01
JAN											
19...	1415	631	8.10	1.0	3.2	<0.010	<0.1	<0.010	<0.010	<0.010	<0.01
MAR											
30...	1745	621	8.20	6.5	9.1	<0.010	<0.1	<0.010	<0.010	<0.010	<0.01
MAY											
24...	1430	636	8.40	20.5	8.8	<0.010	<0.1	<0.010	<0.010	<0.010	0.02
JUN											
06...	1050	642	8.10	21.0	6.6	<0.010	<0.1	<0.010	<0.010	<0.010	0.01
SEP											
13...	0940	635	8.10	19.0	7.2	<0.010	<0.1	<0.010	<0.010	<0.010	<0.01

DATE	DIELDRIN TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)
NOV											
27...	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01
JAN											
19...	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01
MAR											
30...	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01
MAY											
24...	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01
JUN											
06...	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01
SEP											
13...	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01

DATE	MIREX, TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	PCB, TOTAL (UG/L)	PERTHANE TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
NOV											
27...	<0.01	<0.10	<0.01	<0.1	<0.1	<1	<0.01	0.05	<0.01	<0.01	<0.01
JAN											
19...	<0.01	<0.10	<0.01	<0.1	<0.1	<1	<0.01	0.03	<0.01	<0.01	<0.01
MAR											
30...	<0.01	<0.10	<0.01	<0.1	<0.1	<1	<0.01	0.02	<0.01	<0.01	<0.01
MAY											
24...	<0.01	<0.10	<0.01	<0.1	<0.1	<1	<0.01	0.20	<0.01	<0.01	<0.01
JUN											
06...	<0.01	<0.10	<0.01	<0.1	<0.1	<1	<0.01	0.25	<0.01	<0.01	<0.01
SEP											
13...	<0.01	<0.10	<0.01	<0.1	<0.1	<1	<0.01	0.09	<0.01	<0.01	<0.01

04174500 HURON RIVER AT ANN ARBOR, MI

LOCATION.--Lat 42°17'10", long 83°44'00", in NW1/4 sec.28, T.2 S., R.6 E., Washtenaw County, Hydrologic Unit 04090005, on left bank 100 ft upstream from bridge on Wall Street in Ann Arbor, 0.7 mi downstream from Argo Dam, and 4.2 mi upstream from Geddes Dam.

DRAINAGE AREA.--729 mi².

PERIOD OF RECORD.--February 1904 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "at Geddes" February 1904 to December 1914 and as "at Barton" January 1914 to September 1940.

REVISED RECORDS.--WSP 874: 1938. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 744.81 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). February 1904 to December 1914 at Geddes Dam, 4.2 mi downstream, and January 1914 to September 1947 at Barton Dam, 2.6 mi upstream, flow computed from records of operation of powerplants and records of depth of flow over dam and/or flow through undersluices.

REMARKS.--Estimated daily discharges: Jan. 5-8 and Feb. 6-9. Records fair. Diversion upstream from station for Ann Arbor municipal supply had negligible effect on natural flow prior to 1955, figures of runoff adjusted since. Flow regulated by powerplants prior to May 1962. From June 1962 to 1975 occasional regulation for lake level control operations upstream from station. Since 1975 extensive regulation of flow exists due to automation of gates at dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--84 years, 459 ft³/s, 8.55 in/yr, adjusted for diversion since 1955.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 5,840 ft³/s, Mar. 14, 1918; minimum daily, 4 ft³/s, Aug. 2, Sept. 11, 1931, plant leakage, but may be doubtful due to change in leakage.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,770 ft³/s, Apr. 3, gage height, 15.19 ft; minimum daily, 18 ft³/s, July 7-9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	199	498	644	750	739	556	741	333	129	29	84	124
2	219	469	625	717	780	564	724	346	137	27	78	117
3	205	457	615	607	714	613	949	379	159	27	75	136
4	175	518	591	617	838	574	1530	434	133	26	76	166
5	188	618	570	520	709	551	1310	398	122	24	208	154
6	176	502	572	490	670	549	1210	313	106	19	170	145
7	187	488	531	470	640	559	1410	274	94	18	196	139
8	180	433	552	460	610	581	1490	270	91	18	96	135
9	186	507	698	462	580	722	1290	284	93	18	95	127
10	187	612	755	450	559	777	1370	315	78	19	139	124
11	194	465	711	446	530	769	1180	340	79	19	148	125
12	168	444	711	461	526	882	1040	321	63	22	115	145
13	169	438	687	424	543	1010	820	298	66	22	108	144
14	176	437	655	399	528	969	617	285	65	21	109	132
15	189	437	854	391	551	981	728	253	59	19	212	114
16	176	430	1110	380	542	926	857	273	53	46	150	120
17	214	446	975	454	550	896	853	337	59	137	172	113
18	193	441	904	577	537	857	701	307	59	86	312	132
19	204	392	842	625	553	857	679	294	57	76	292	184
20	197	425	1040	663	546	787	663	277	46	70	176	220
21	197	368	1160	723	553	763	637	191	40	78	159	195
22	216	398	1060	658	562	724	529	194	73	98	152	245
23	236	458	967	626	628	706	453	201	56	95	205	496
24	348	402	1010	596	627	706	462	259	52	94	186	586
25	358	579	1010	580	589	746	491	247	47	157	159	444
26	291	659	1020	552	550	766	484	186	40	181	147	322
27	381	615	953	508	563	741	484	169	32	113	160	317
28	418	575	912	480	547	734	495	156	33	103	160	328
29	407	620	929	474	543	795	486	157	37	88	146	375
30	416	631	922	476	---	788	501	149	34	98	133	347
31	468	---	852	507	---	800	---	137	---	103	126	---
TOTAL	7518	14762	25437	16543	17407	23249	25184	8377	2192	1951	4744	6451
MEAN	243	492	821	534	600	750	839	270	73.1	62.9	153	215
MAX	468	659	1160	750	838	1010	1530	434	159	181	312	586
MIN	168	368	531	380	526	549	453	137	32	18	75	113
MEAN+	265	513	836	551	617	767	859	295	113	99.9	179	238
CFSM+	.36	.70	1.15	.76	.85	1.05	1.18	.40	.16	.14	.25	.33
IN+	.42	.78	1.32	.87	.91	1.21	1.31	.47	.17	.16	.28	.36

CAL YR 1987 TOTAL 136190 MEAN 373 MAX 1160 MIN 72 MEAN+ 396 CFSM+ .54 IN+ 7.37
WTR YR 1988 TOTAL 153815 MEAN 420 MAX 1530 MIN 18 MEAN+ 444 CFSM+ .61 IN+ 8.28

+ Adjusted for diversion for municipal supply; record furnished by City of Ann Arbor.

04174950 WILLOW RUN NEAR RAWSONVILLE, MI

LOCATION.--Lat 42°13'09", long 83°32'13", in SW1/4 sec.18, T.3 S., R.8 E., Wayne County, Hydrologic Unit 04090005, on right bank 30 ft upstream from culverts on North I-94 Service Road, 0.7 mi upstream from mouth, and 0.8 mi northeast of Rawsonville.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--April 1986 to current year (seasonal records only, April to September).

GAGE.--Water-stage recorder. Elevation of gage is 670 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records good. Actual surface drainage area is 6.28 mi². Flow contains effluent from sewage-treatment plant about 1 mi upstream from station. Some of this flow originates from ground-water sources and other sources outside the basin. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge during period April to September, 117 ft³/s, Aug. 22, 1987; minimum daily, 21 ft³/s, Aug. 31, Sept. 1, 18, 1986, July 5, 1987.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							32	29	31	27	31	28
2							30	29	33	26	32	27
3							41	30	26	24	31	35
4							34	32	29	23	28	42
5							32	29	29	25	33	29
6							41	31	29	27	42	27
7							40	30	30	28	33	28
8							36	27	32	31	31	29
9							34	45	29	30	33	28
10							32	33	31	26	32	28
11							33	31	32	31	34	25
12							33	30	29	32	32	34
13							33	29	29	30	33	30
14							33	29	31	30	30	28
15							32	43	30	30	49	28
16							33	33	31	32	37	28
17							32	32	30	62	32	28
18							31	31	31	30	73	29
19							32	30	28	30	32	29
20							31	33	28	31	31	32
21							32	32	32	29	24	29
22							33	28	37	28	27	40
23							34	29	45	31	40	104
24							32	31	30	29	30	34
25							32	30	29	29	27	30
26							29	32	28	31	28	32
27							34	29	25	29	30	29
28							33	28	28	29	29	29
29							32	26	28	33	23	29
30							31	25	28	33	25	30
31							---	32	---	32	28	---
TOTAL							997	958	908	938	1020	978
MEAN							33.2	30.9	30.3	30.3	32.9	32.6
MAX							41	45	45	62	73	104
MIN							29	25	25	23	23	25

04175600 RIVER RAISIN NEAR MANCHESTER, MI

LOCATION.--Lat 42°10'05", long 84°04'34", in NE1/4 SE1/4 sec.33, T.3 S., R.3 E., Washtenaw County, Hydrologic Unit 04100002, on left bank at downstream side of bridge on Sharon Valley Road, and 2.5 mi northwest of Manchester.

DRAINAGE AREA.--132 mi^2.

PERIOD OF RECORD.--January 1970 to September 1981, January 1985 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 900 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to July 30, 1970, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 31 to Jan. 30, Feb. 4-18, and July 3-11, 14-16. Records good except for estimated daily discharges, which are fair. Occasional regulation caused by many dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--14 years (water years 1971-81, 1986-88), 101 ft^3/s, 10.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 869 ft^3/s, Feb. 24, 1985, gage height, 7.21 ft; minimum, 4.5 ft^3/s, Nov. 29, 1971; minimum gage height, 1.16 ft, Oct. 12, Nov. 4, 1978.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 280 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Apr. 7	1500	*320	*4.91	No other peak greater than base discharge.			

Minimum daily discharge, 5.7 ft^3/s, July 9, 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	33	62	123	135	206	117	150	100	29	7.4	11	12
2	39	75	121	130	221	118	146	94	27	6.8	10	12
3	37	72	116	125	211	129	155	89	26	6.4	9.2	14
4	36	68	113	122	170	122	194	84	24	7.0	8.3	18
5	29	61	110	118	130	117	193	61	23	6.1	7.8	32
6	35	57	105	112	110	116	199	75	21	6.0	18	28
7	36	57	100	103	120	121	302	73	19	5.9	24	24
8	32	59	110	95	130	137	305	71	16	5.8	17	22
9	30	59	145	88	125	166	277	76	16	5.7	14	18
10	35	55	160	82	120	163	242	82	15	6.4	14	16
11	33	52	146	78	110	157	215	74	15	7.6	33	15
12	29	51	147	76	105	163	198	69	14	7.4	21	16
13	31	51	141	74	100	185	189	69	13	6.7	17	25
14	31	49	128	70	105	170	188	64	12	6.0	14	24
15	31	47	151	67	115	160	181	62	12	5.7	13	20
16	30	48	218	80	130	153	176	82	12	6.5	11	17
17	32	50	198	94	145	147	165	74	11	11	10	17
18	35	62	183	110	140	145	159	66	10	13	18	19
19	33	61	173	120	138	142	146	61	9.6	12	22	28
20	33	58	200	135	134	137	139	60	9.3	11	20	57
21	40	53	224	125	130	130	132	60	9.1	11	16	62
22	45	47	202	110	150	125	123	59	8.7	12	14	56
23	46	45	188	105	143	124	121	57	9.1	12	17	137
24	53	50	179	100	139	139	127	56	8.8	13	23	155
25	71	75	191	96	125	157	117	53	8.2	16	21	121
26	67	135	188	96	131	170	113	33	8.3	27	17	99
27	79	126	177	95	119	161	108	30	7.9	23	14	86
28	79	114	169	94	115	150	116	35	7.8	18	16	75
29	70	119	164	94	113	155	113	34	7.7	15	17	65
30	63	126	145	110	---	163	106	33	7.3	13	15	57
31	57	---	140	163	---	157	---	31	---	12	13	---
TOTAL	1330	2044	4855	3202	3930	4496	5095	1987	416.8	322.4	495.3	1347
MEAN	42.9	68.1	157	103	136	145	170	64.1	13.9	10.4	16.0	44.9
MAX	79	135	224	163	221	185	305	100	29	27	33	155
MIN	29	45	100	67	100	116	106	30	7.3	5.7	7.8	12
CFSM	.33	.52	1.19	.78	1.03	1.10	1.29	.49	.11	.08	.12	.34
IN.	.37	.58	1.37	.90	1.11	1.27	1.44	.56	.12	.09	.14	.38

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CAL YR 1987   TOTAL   25279.0    MEAN 69.3    MAX 224    MIN 6.6    CFSM .53    IN 7.12
WTR YR 1988   TOTAL   29520.5    MEAN 80.7    MAX 305    MIN 5.7    CFSM .61    IN 8.32
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04176000 RIVER RAISIN NEAR ADRIAN, MI

LOCATION.--Lat 41°54'15", long 83°58'50", in NW1/4 sec.5, T.7 S., R.4 E., Lenawee County, Hydrologic Unit 04100002, on right bank at downstream side of bridge on Academy Road, 1.7 mi east of Adrian, and 2.6 mi downstream from South Branch.

DRAINAGE AREA.--463 mi^2.

PERIOD OF RECORD.--October 1953 to September 1978, October 1978 to September 1984 (operated as a crest-stage partial-record station only), October 1984 to current year. Records for October 1930 to August 1931 and October 1932 to April 1938, published as "Raisin River" in WSP 714, 744, 759, 784, 804, 824, and 854, have been found to be unreliable and should not be used.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 693.2 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 31 to Jan. 19, Jan. 26-31, and Feb. 4-28. Records good except for estimated daily discharges, which are poor. Diurnal fluctuation caused by powerplant at Tecumseh, 11 mi upstream from station, prior to June 27, 1968. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--29 years (water years 1954-78, 1985-88), 321 ft^3/s, 9.42 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft^3/s, Mar. 15, 1982, gage height, 15.77 ft; minimum, 18 ft^3/s, Aug. 10, 1964, gage height, 1.33 ft; minimum daily, 25 ft^3/s, Oct. 26, 1965.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft^3/s and maximum (*):

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Dec. 17	1000	2,020	11.40	Apr. 5	1200	*2,730	*12.37
Dec. 22	0400	1,630	10.75				

Minimum discharge, 33 ft^3/s, July 14, 15; minimum gage height, 1.95 ft, July 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	155	229	627	430	1070	558	468	285	106	47	47	60
2	149	224	552	410	1240	560	462	272	103	45	45	58
3	130	232	523	405	1150	661	474	250	90	44	41	96
4	124	232	458	395	940	633	1130	238	96	42	38	97
5	121	220	410	390	800	513	2500	236	97	40	39	102
6	114	206	372	350	660	465	1790	225	93	39	64	90
7	108	195	351	320	520	471	1520	216	87	38	58	87
8	106	188	370	280	440	528	1630	203	85	37	52	82
9	109	186	717	250	400	662	1440	209	81	36	50	76
10	107	175	1060	240	370	777	1130	214	74	36	49	69
11	110	167	1160	230	340	698	908	210	62	37	60	66
12	107	163	911	225	325	638	738	205	69	37	108	63
13	130	158	731	220	305	753	658	198	71	38	102	66
14	112	152	579	215	290	810	586	189	69	35	78	66
15	126	149	804	210	310	653	531	185	67	34	66	67
16	111	146	1540	200	350	552	504	195	65	36	60	66
17	109	146	1940	230	380	500	471	191	63	46	56	67
18	111	162	1480	700	420	470	437	195	62	46	86	65
19	112	161	1100	950	470	458	418	184	61	55	122	71
20	115	168	1020	969	450	446	392	192	60	50	137	102
21	124	167	1380	926	430	420	374	184	59	50	99	103
22	121	157	1550	825	460	393	357	178	57	49	77	115
23	130	154	1180	524	740	380	348	171	60	49	85	171
24	152	164	896	442	900	448	340	171	55	53	85	231
25	211	297	929	377	750	589	331	152	52	55	76	270
26	163	627	1060	330	550	709	320	150	51	69	72	230
27	261	793	961	290	520	667	305	144	48	67	68	192
28	371	674	742	265	500	547	306	109	49	63	75	164
29	361	562	647	255	502	492	300	112	51	56	68	159
30	292	629	499	265	---	490	293	113	49	50	64	158
31	252	---	460	720	---	487	---	108	---	51	62	---
TOTAL	4804	7883	27009	12838	16582	17428	21461	5884	2092	1430	2189	3309
MEAN	155	263	871	414	572	562	715	190	69.7	46.1	70.6	110
MAX	371	793	1940	969	1240	810	2500	285	106	69	137	270
MIN	106	146	351	200	290	380	293	108	48	34	38	58
CFSM	.34	.57	1.88	.89	1.24	1.21	1.54	.41	.15	.10	.15	.24
IN.	.39	.63	2.17	1.03	1.33	1.40	1.72	.47	.17	.11	.18	.27

CAL YR 1987 TOTAL 104891 MEAN 287 MAX 1940 MIN 50 CFSM .62 IN 8.43
WTR YR 1988 TOTAL 122909 MEAN 336 MAX 2500 MIN 34 CFSM .73 IN 9.88

04176500 RIVER RAISIN NEAR MONROE, MI
(National stream quality accounting network station)

LOCATION.--Lat 41°57'38", long 83°31'52", Monroe County, Hydrologic Unit 04100002, on left bank 0.8 mi downstream from bridge on Ida Maybee Road, 5.0 mi downstream from Saline River, and 7.5 mi west of Monroe.

DRAINAGE AREA.--1,042 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1937 to current year. Published as "Raisin River at Monroe" 1937-52 and as "River Raisin at Monroe" 1952-53.

REVISED RECORDS.--WSP 954: 1938-40(M), 1941. WSP 1437: 1939, 1948. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 616.26 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1953, at site 9 mi downstream at datum 46.26 ft lower.

REMARKS.--Estimated daily discharges: Dec. 31 to Jan. 17, Jan. 22-30, Feb. 3 to Mar. 1, and Mar. 4-6. Water-discharge records good except for estimated daily discharges, which are fair. Diurnal fluctuation caused by powerplants upstream from station prior to June 27, 1968. At times, flow is affected by irrigation pumpage.

AVERAGE DISCHARGE.--51 years, 727 ft³/s, 9.47 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 15,300 ft³/s, Mar. 16, 1982, gage height, 10.4 ft; maximum gage height, 11.16 ft, Mar. 15, 1982, backwater from ice; minimum discharge, about 2 ft³/s, Sept. 4, 1938, Sept. 19, 20, 1941, site then in use.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Dec. 16	0800	*4,520	*6.92	Dec. 20	2400	4,490	6.90

Minimum discharge, 24 ft³/s, July 14, 17, gage height, 1.65 ft, caused by irrigation pumpage.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	175	414	1320	820	1820	1050	862	414	170	55	87	89
2	178	368	1410	760	2360	1150	848	403	166	53	85	85
3	190	357	1200	750	2250	1330	892	395	164	54	81	87
4	197	343	1110	740	2050	1180	1170	377	157	52	82	93
5	188	334	942	720	1700	1100	1510	353	148	50	75	130
6	176	323	786	660	1200	950	2080	339	138	47	62	184
7	172	296	695	600	1000	879	2800	326	133	46	81	173
8	162	281	751	520	840	880	2970	319	129	44	76	153
9	151	273	1770	480	750	1080	2790	320	126	42	83	133
10	146	261	2020	440	700	1290	2440	336	111	42	80	121
11	149	255	2030	430	650	1370	2110	359	106	42	75	109
12	147	244	2160	425	600	1380	1690	368	101	38	84	107
13	151	236	1940	420	570	1550	1310	344	98	36	86	100
14	151	228	1570	410	550	1500	1090	321	88	28	100	94
15	153	215	2440	400	580	1420	948	302	85	41	120	87
16	157	208	4290	370	670	1230	844	293	82	29	114	86
17	149	213	3550	380	720	1020	766	289	85	29	95	86
18	148	212	3570	1060	800	894	717	288	80	45	96	84
19	139	207	3410	1100	900	841	668	279	76	63	101	84
20	144	206	3790	1510	920	791	625	279	72	64	116	101
21	143	202	3800	1880	900	743	581	281	73	74	148	104
22	137	205	2990	1650	870	696	547	277	106	74	171	116
23	141	212	2850	1450	1400	660	528	263	87	74	172	155
24	152	210	2630	1200	1750	696	502	259	71	73	143	255
25	168	367	2860	900	1800	1260	489	249	66	80	127	327
26	194	1350	2290	700	1600	1790	472	279	52	84	124	320
27	297	1350	2010	560	1300	1910	464	298	53	94	110	326
28	442	1370	1880	500	1050	1620	454	250	51	96	107	287
29	476	1520	1630	480	1000	1250	440	225	49	101	99	256
30	553	1450	1280	500	---	1030	428	197	52	107	101	228
31	498	---	1000	972	---	922	---	176	---	112	97	---
TOTAL	6424	13710	65974	23787	33300	35462	34035	9458	2975	1869	3186	4560
MEAN	207	457	2128	767	1148	1144	1135	305	99.2	60.3	103	152
MAX	553	1520	4290	1880	2360	1910	2970	414	170	112	172	327
MIN	137	202	695	370	550	660	428	176	49	28	62	84
CFSM	.20	.44	2.04	.74	1.10	1.10	1.09	.29	.10	.06	.10	.15
IN.	.23	.49	2.36	.85	1.19	1.27	1.22	.34	.11	.07	.11	.16

CAL YR 1987 TOTAL 217812 MEAN 597 MAX 4290 MIN 58 CFSM .57 IN 7.78
WTR YR 1988 TOTAL 234740 MEAN 641 MAX 4290 MIN 28 CFSM .62 IN 8.38

04176500 RIVER RAISIN NEAR MONROE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966-75, 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to July 1981.
WATER TEMPERATURE: March 1966 to September 1972, April 1978 to July 1981.
SUSPENDED-SEDIMENT DISCHARGE: March 1966 to September 1972.

INSTRUMENTATION.--Water-quality monitor from Mar. 23 to July 13, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at gaging station, or 0.8 mi upstream from gage at bridge on Ida Maybee Road.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-81): Maximum daily, 1,020 microsiemens, Feb. 16, 1979; minimum daily recorded (more than 20 percent missing record), 263 microsiemens, Jan. 25, 1981.
WATER TEMPERATURE (water years 1967, 1970-72, 1979-80): Maximum daiy recorded (more than 20 percent missing record), 32.0°C, July 18, 1972; minimum daily, 0.0°C on many days during winter.
SEDIMENT CONCENTRATION (water years 1967-72): Maximum daily mean, 1,430 mg/L, Dec. 22, 1967; minimum daily mean, 1 mg/L on several days in 1970.
SEDIMENT LOAD: Maximum daily, 28,000 tons, Dec. 22, 1967; minimum daily, 0.29 ton, Aug. 31, 1971.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 200 microsiemens was measured Feb. 25, 1985.

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	TIME	STREAM-FLOW, INSTAN-TANEOUS (CFS)	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
DEC										
10...	1030	2010	676	8.1	5.5	56	--	--	K800	8800
MAR										
30...	1000	1030	644	8.3	8.0	17	12.0	103	K50	K40
JUN										
06...	1400	139	768	8.5	25.0	14	11.2	140	K92	2600
SEP										
13...	1400	98	635	8.6	21.5	8.0	12.0	--	K31	K170

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB WH WAT TOT FLD MG/L AS CACO3	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
DEC										
10 ..	320	--	97	20	12	7	0.3	3.9	--	--
MAR										
30 ...	310	110	92	20	12	8	0.3	6.3	242	0
JUN										
06...	340	120	95	26	24	13	0.6	10	259	10
SEP										
13...	270	92	70	24	32	20	0.9	4.4	198	12

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
DEC									
10...	--	--	--	0.20	7.9	406	--	--	0.030
MAR									
30...	198	80	36	0.30	5.2	406	0.55	1130	0.020
JUN									
06...	228	87	49	0.40	3.5	482	0.66	181	0.030
SEP									
13...	182	78	50	0.30	2.0	371	0.50	98.2	<0.010

04176500 RIVER RAISIN NEAR MONROE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHOROUS TOTAL (MG/L AS P)	PHOS-PHOROUS DIS-SOLVED (MG/L AS P)	PHOS-PHOROUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)
DEC 10...	9.00	0.080	0.060	1.0	0.200	0.050	0.040	30	1	44
MAR 30...	4.90	0.080	0.090	0.70	0.050	0.030	<0.010	<10	<1	44
JUN 06...	1.10	--	0.060	0.60	0.050	0.020	<0.010	<10	2	63
SEP 13...	0.800	<0.010	<0.010	0.50	0.120	0.020	<0.010	<10	1	57

DATE	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)
DEC 10...	<0.5	<1	<1	<3	5	27	<5	6	11	<0.1
MAR 30...	<0.5	<1	<1	<3	1	11	<5	19	22	<0.1
JUN 06...	<0.5	<1	<1	<3	4	<3	<5	15	4	<0.1
SEP 13...	<0.5	2	<1	<3	2	8	<5	6	5	<0.1

DATE	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
DEC 10...	<10	3	<1	<1.0	300	<6	5	109	592	99
MAR 30...	<10	3	<1	1.0	370	<6	<3	35	97	96
JUN 06...	10	6	<1	1.0	660	<6	<3	25	9.4	--
SEP 13...	10	2	<1	<1.0	450	<6	9	26	6.9	90

04176605 OTTER CREEK AT LA SALLE, MI

LOCATION.--Lat 41°52'01", long 83°27'13", in NW1/4 NW1/4 sec.23 (private claim 47), T.7 S., R.8 E., Monroe County, Hydrologic Unit 04100001, on right bank 150 ft upstream from bridge on State Highway 125, 2.3 mi downstream from South Branch, and 4.6 mi southwest of Monroe.

DRAINAGE AREA.--51.0 mi².

PERIOD OF RECORD.--October 1987 to September 1988.

GAGE.--Water-stage recorder. Elevation of gage is 580 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 30 to Feb. 29 and July 17 to Aug. 18. Records poor. Several measurements of water temperature were made during the year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 595 ft³/s, Dec. 15, gage height, 8.72 ft; maximum gage height, 9.17 ft, Feb. 23, backwater from ice; no flow June 21 to July 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.5	13	101	35	110	49	46	16	1.4	.00	.25	.13
2	5.1	12	113	29	80	50	84	15	1.2	.00	.12	.27
3	4.3	13	89	24	40	58	106	14	1.9	.00	.13	.25
4	3.7	13	87	20	27	44	172	14	2.3	.00	.15	.62
5	3.3	11	78	17	23	36	116	14	1.7	.00	.45	2.3
6	3.3	8.3	65	14	21	35	92	15	1.2	.00	.70	2.8
7	3.5	7.1	56	12	19	36	159	15	1.7	.00	.20	1.7
8	3.2	6.6	97	11	18	43	129	15	.76	.00	.10	1.2
9	2.8	8.7	205	11	17	71	88	16	.62	.00	.07	.65
10	2.9	10	169	12	17	71	67	18	.60	.00	.10	.38
11	3.4	9.1	114	11	16	60	53	17	.87	.00	.15	.22
12	3.7	8.1	134	11	16	64	41	14	.92	.00	.22	.32
13	3.8	7.6	104	12	16	100	35	13	.80	.00	.15	.32
14	3.5	6.8	76	11	18	73	31	12	.53	.00	.11	.19
15	3.3	5.9	338	11	45	52	26	10	.45	.00	.09	.12
16	3.0	5.7	368	12	40	44	22	8.9	.27	.00	.07	.12
17	3.0	5.7	204	50	37	38	20	7.6	.14	2.5	.06	.10
18	3.3	6.3	135	150	34	39	19	6.4	.06	.40	.05	.10
19	3.7	5.9	106	60	31	38	17	5.8	.02	.20	.07	.10
20	3.6	5.7	215	75	29	34	15	5.5	.01	.15	.04	.17
21	3.5	4.4	197	85	25	30	15	5.9	.00	.08	.04	.13
22	3.5	4.6	130	40	50	28	14	5.7	.00	.06	.04	.12
23	3.9	4.7	105	23	100	29	14	4.7	.00	.05	.08	.96
24	4.2	4.5	95	20	70	206	15	4.0	.00	.10	.12	3.7
25	8.0	86	123	18	50	236	13	5.3	.00	.15	.08	2.8
26	8.7	216	108	16	35	153	13	3.8	.00	.25	.06	1.9
27	25	129	84	15	30	104	13	3.1	.00	.10	.06	1.2
28	46	96	73	14	27	76	16	2.7	.00	.14	.44	.74
29	28	128	67	13	40	68	19	2.4	.00	.07	.25	.49
30	20	120	55	20	---	62	17	2.0	.00	.25	.18	.38
31	15	---	45	50	---	51	---	1.8	---	.90	.14	---
TOTAL	237.7	962.7	3936	902	1081	2078	1487	293.6	17.45	5.40	4.77	24.48
MEAN	7.67	32.1	127	29.1	37.3	67.0	49.6	9.47	.58	.17	.15	.82
MAX	46	216	368	150	110	236	172	18	2.3	2.5	.70	3.7
MIN	2.8	4.4	45	11	16	28	13	1.8	.00	.00	.04	.10
CFSM	.15	.63	2.49	.57	.73	1.31	.97	.19	.01	.00	.00	.02
IN	.17	.70	2.87	.66	.79	1.52	1.08	.21	.01	.00	.00	.02

WTR YR 1988 TOTAL 11030.10 MEAN 30.1 MAX 368 MIN .00 CFSM .59 IN 8.05

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

As the number of streams on which streamflow information is likely to be desired far exceeds the number of stream-gaging stations feasible to operate at one time, the Geological Survey collects limited streamflow data at sites other than stream-gaging stations. When limited streamflow data are collected on a systematic basis over a period of years for use in hydrologic analyses, the site at which the data are collected is called a partial-record station. Data collected at these partial-record stations are usable in low-flow or floodflow analyses, depending on the type of data collected. In addition, discharge measurements are made at other sites not included in the partial-record program. These measurements are generally made in time of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Records collected at partial-record stations are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage partial-record stations and the second is a table of discharge measurements at low-flow partial-record stations. Discharge measurements at miscellaneous sites are given in a third table.

Crest-stage partial-record stations

The following table contains annual maximum discharge for crest-stage stations. A crest-stage gage is a device which will register the peak stage occurring between inspections of the gage. A stage-discharge relation for each gage is developed from discharge measurements made by indirect measurements of peak flow or by current meter. The date of the maximum discharge is not always certain but is usually determined by comparison with nearby continuous-record stations, weather records, or local inquiry. Only the maximum discharge for each water year is given. Information on some lower floods may have been obtained but is not published herein. The years given in the period of record represent water years for which the annual maximum has been determined.

Annual maximum discharge at crest-stage partial-record stations during water year 1988

Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Annual Maximum		
					Date	Gage height (ft)	Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE SUPERIOR					
04041000	Perch River near Sidnaw, MI	Lat 46°31'06", long 88°39'48", in NE1/4 sec.34, T.48 N., R.35 W., Baraga County, Hydrologic Unit 04020104, at State Highway 28, 2.5 mi east of Sidnaw.	63.1	1913-15†, 1957-88	04-07-88	9.24	356
04044200	Carp Creek at Ishpeming, MI	Lat 46°29'11", long 87°41'21", in NW1/4 sec.9, T.47 N., R.27 W., Marquette County, Hydrologic Unit 04020105, at Highway 41A in Ishpeming.	16.5	1970-88	04-07-88	6.34	146
04044813	Two Hearted River near Paradise, MI	Lat 46°41'57", long 85°25'19", in NW1/4 SW1/4 sec.27, T.50 N., R.9 W., Luce County, Hydrologic Unit 04020201, at footbridge in State Forest Campground, 0.4 mi upstream from mouth, and 18 mi northwest of Paradise.	201	1973-88	04-09-88	5.14	a2,500
04045538	West Branch Waiska River near Brimley, MI	Lat 46°21'18", long 84°35'35", in SW1/4 NW1/4 sec.29, T.46 N., R.2 W., Chippewa County, Hydrologic Unit 04020203, at county road, 3.2 mi upstream from mouth, and 3.5 mi south of Brimley.	40.7	1973-88	04-06-88	9.84	1,140
04045559	East Branch Waiska River near Brimley, MI	Lat 46°25'07", long 84°28'24", in NW1/4 NE1/4 sec.6, T.46 N., R.1 W., Chippewa County, Hydrologic Unit 04020203, at county road, 4.0 mi upstream from mouth, and 4.7 mi east of Brimley.	30.1	1973-88	04-06-88	b13.41	1,230
		STREAMS TRIBUTARY TO LAKE MICHIGAN					
04046000	Black River near Garnet, MI	Lat 46°07'05", long 85°21'55", in SE1/4 sec.13, T.43 N., R.9 W., Mackinac County, Hydrologic Unit 04060107, on right bank 10 ft upstream from footbridge, 15 ft downstream from Peters Creek, 3.5 mi upstream from mouth, and 4 mi southwest of Garnet.	c28	1951-78†, 1979-88	04-06-88	5.83	288
04057900	Black River near Republic, MI	Lat 42°25'08", long 87°53'21", in NE1/4 sec.2, T.46 N., R.29 W., Marquette County, Hydrologic Unit 04030110, at county road, 4.4 mi east of Republic.	34.4	1961-68†, 1970-88	04-07-88	3.89	312
04059400	Tenmile Creek at Perronville, MI	Lat 45°48'38", long 87°22'00", in NW1/4 NW1/4 sec.2, T.39 N., R.25 W., Menominee County, Hydrologic Unit 04030109, at county road, 1 mi northwest of Perronville, and 11.5 mi upstream from Ford River.	38.4	1971-77†, 1978-88	04-06-88	5.40	606

See footnotes at end of table.

Annual maximum discharge at crest-stage partial-record stations during water year 1988--Continued

STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued

Station No.	Station Name	Location	Drainage area (mi²)	Period of record	Annual Maximum Date	Annual Maximum Gage height (ft)	Annual Maximum Dis-charge (ft³/s)
04062300	Michigamme River at Republic, MI	Lat 46°23'03", long 87°58'46", in SE1/4 sec.18, T.46 N., R.29 W., Marquette County, Hydrologic Unit 04030107, on left bank 400 ft upstream from county highway, 0.3 mi upstream from Trout Falls Creek, and 0.6 mi south of Republic.	240	1961-75†, 1976-88	04-12-88	5.48	2,060
04096272	Beebe Creek near Hillsdale, MI	Lat 41°57'15", long 84°38'20", in NE1/4 NE1/4 sec.15, T.6 S., R.3 W., Hillsdale County, Hydrologic Unit 04050001, at Moore Road, 1.2 mi northwest of Hillsdale.	42.4	1974-78†, 1979-88	04-08-88	5.51	182
04096340	St. Joseph River at Clarendon, MI	Lat 42°07'51", long 84°51'56", in SW1/4 SW1/4 sec.11, T.4 S., R.5 W., Calhoun County, Hydrologic Unit 04050001, at 22 Mile Road in Clarendon.	144	1974-77†, 1978-88	04-07-88	d6.58	404
04097170	Portage River near Vicksburg, MI	Lat 42°06'53", long 85°29'08", in SW1/4 sec.16, T.4 S., R.10 W., Kalamazoo County, Hydrologic Unit 04050001, at W Avenue, 2.4 mi east of Vicksburg.	68.2	1946-51†, 1965-80†, 1980-88	04-08-88	e4.62	122
04108645	Rabbit River at Hamilton, MI	Lat 42°40'31", long 86°00'13", in NE1/4 sec.6, T.3 N., R.14 W., Allegan County, Hydrologic Unit 04050003, at State Highway 40 in Hamilton.	274	1979-88	12-22-87	13.78	1,260
04112700	Sycamore Creek near Mason, MI	Lat 42°36'38", long 84°27'58", in NE1/4 NE1/4 sec.31, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Harper Road, 0.7 mi downstream from Aurelius and Vevay Drain, and 2.6 mi northwest of Mason.	39.5	1975-88	04-07-88	9.51	250
04113090	Carrier Creek near Grand Ledge, MI	Lat 42°43'36", long 84°39'16", in SE1/4 SW1/4 sec.15, T.4 N., R.3 W., Eaton County, Hydrologic Unit 04050004, at St. Joe Highway, 3.7 mi upstream from mouth, and 4.0 mi southeast of Grand Ledge.	7.18	1975-88	04-07-88	7.06	177
04117000	Quaker Brook near Nashville, MI	Lat 42°33'57", long 85°05'37", in NW1/4 sec. 13, T.2 N., R.7 W., Barry County, Hydrologic Unit 04050007, on left bank 150 ft upstream from culvert on county road, 500 ft upstream from small tributary, and 2.5 mi south of Nashville.	7.60	1954-75†, 1976-88	09-23-88	6.17	191
04119055	Plaster Creek at Grand Rapids, MI	Lat 42°54'46", long 85°39'02", in SE1/4 sec.7, T.6 N., R.11 W., Kent County, Hydrologic Unit 04050006, at 28th Street in Grand Rapids.	46.6	1974-88	02-01-88	8.16	622
04119160	Buck Creek at Grandville, MI	Lat 42°54'09", long 85°45'46", in SE1/4 sec.18, T.6 N., R.12 W., Kent county, Hydrologic Unit 04050006, at Wilson Avenue in Grandville.	50.5	1974-88	02-01-88	7.54	492
*04120295	Black Creek near Muskegon, MI	Lat 43°12'14", long 86°09'52", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon, and 4.9 mi upstream from mouth.	c39	1975, 1977, 1979-88	01-31-88	3.64	273
04122230	North Branch Pentwater River near Pentwater, MI	Lat 43°47'42", long 86°21'30", in NE1/4 SE1/4 sec.8, T.16 N., R.17 W., Oceana County, Hydrologic Unit 04060101, at Oceana Drive, 3.5 mi northeast of Pentwater.	42.3	1975-88	02-01-88	3.47	334
04124500	East Branch Pine River near Tustin, MI	Lat 44°06'09", long 85°31'02", in NE1/4 NW1/4 sec.28, T.20 N., R.10 W., Osceola County, Hydrologic Unit 04060103, at Marion Road, 3.0 mi west of Tustin.	f60.0	1952-63†, 1964-88	02-02-88	5.16	572

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations during water year 1988--Continued

Station No.	Station Name	Location	Drainage area (mi²)	Period of record	Annual Maximum		
					Date	Gage height (ft)	Dis-charge (ft³/s)
		STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued					
04126600	Betsie River near Benzonia, MI	Lat 44°36'02", long 86°05'57", in NW1/4 NW1/4 sec.2, T.25 N., R.15 W., Benzie County, Hydrologic Unit 04060104, at U.S. Highway 31, 1.2 mi south of Benzonia.	c170	1975-88	04-04-88	g3.96	616
04127850	Boyne River near Boyne City, MI	Lat 45°11'48", long 84°57'26", in NW1/4 SW1/4 sec.5, T.32 N., R.5 W., Charlevoix County, Hydrologic Unit 04060105, at Dam Road, 0.3 mi downstream from Boyne River hydroelectric plant, and 2.8 mi southeast of Boyne City.	64.2	1975-88	04-04-88	3.02	336
		STREAMS TRIBUTARY TO LAKE HURON					
04139000	Houghton Creek near Lupton, MI	Lat 44°23'45", long 84°02'50", in SE1/4 SE1/4 sec.10, T.23 N., R.3 E., Oegmaw County, Hydrologic Unit 04080101, 2.7 mi southwest of Lupton.	29.7	1950-73‡, 1973-88	03-30-88	5.51	251
04140200	Klacking Creek near Selkirk, MI	Lat 44°20'05", long 84°08'46", in NE1/4 NE1/4 sec.2, T.22 N., R.2 E., Ogemaw County, Hydrologic Unit 04080101, at Campbell Road, 4.0 mi northwest of Selkirk.	7.51	1953-88	03-30-88	1.83	84
04140500	Rifle River at Selkirk, MI	Lat 44°18'48", long 84°04'10", in SE1/4 NE1/4 sec.9, T.22 N., R.3 E., Ogemaw County, Hydrologic Unit 04080101, at State Road in Selkirk.	117	1950-82‡, 1983-88	03-30-88	h4.09	1,130
04141100	Shepards Creek near Selkirk, MI	Lat 44°18'27", long 84°05'05", in SE1/4 SE1/4 sec.8, T.22 N., R.3 E., Ogemaw County, Hydrologic Unit 04080101, at Bedtelyon Road, 1.1 mi southwest of Selkirk.	4.44	1953-78, 1988	03-30-88	4.00	173
04146020	South Branch Flint River near Millville, MI	Lat 43°04'44", long 83°18'25", in SE1/4 sec. 29, T.8 N., R.10 E., Lapeer County, Hydrologic Unit 04080204, at Saginaw Road, 1.6 mi north of Lapeer.	160	1974-87	12-21-87	7.24	449
04146450	North Branch Flint River near Columbiaville, MI	Lat 43°11'18", long 83°22'03", in NW1/4 sec. 24, T.9 N., R.9 E., Lapeer County, Hydrologic Unit 04080204, at Barnes Lake Road, 2.9 mi northeast of Columbiaville.	223	1987-87	12-21-87	13.34	767
04148265	Kimball Drain near Swartz Creek, MI	Lat 42°55'15", long 83°49'51", in NE1/4 sec.14, T.6 N., R.5 E., Genesee County, Hydrologic Unit 04080204, at Morrish Road, 2.4 mi south of Swartz Creek.	10.6	1970-88	04-07-88	4.81	118
04148610	Cole Creek near Flushing, MI	Lat 43°02'44", long 83°51'06", in SW1/4 sec.35, T.8 N., R.5 E., Genesee County, Hydrologic Unit 04080204, at Potter Road, 1.2 mi south of Flushing.	8.51	1970-88	12-20-87	5.67	128
04148640	Armstrong Creek near Montrose, MI	Lat 43°08'04", long 83°50'03", in SE1/4 sec.35, T.9 N., R.5 E., Genesee County, Hydrologic Unit 04080204, at Morrish Road, 4.1 mi southeast of Montrose.	11.9	1970-88	12-20-87	6.28	153
		STREAMS TRIBUTARY TO ST. CLAIR RIVER					
04160350	Pine River near Rattle Run, MI	Lat 42°52'49", long 82°34'04", in NE1/4 sec.9, T.5 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, at Gratiot Road, 1.9 mi northeast of Rattle Run.	135	1974-88	03-09-88	15.39	1,200
		STREAMS TRIBUTARY TO LAKE ST. CLAIR					
04161000	Clinton River at Auburn Heights, MI	Lat 42°38'00", long 83°13'28", in NW1/4 sec. 36, T.3 N., R.10 E., Oakland County, Hydrologic Unit 04090003, at Auburn Road in Auburn Heights.	123	1935-40‡, 1957-82‡, 1983-88	07-22-88	4.63	1,250

See footnotes at end of table.

Annual maximum discharge at crest-stage partial-record stations during water year 1988--Continued

					Annual Maximum		
Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Date	Gage height (ft)	Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE ST. CLAIR--Continued					
04161500	Paint Creek near Lake Orion, MI	Lat 42°46'03", long 83°13'12", in NE1/4 sec.13, T.4 N., R.10 E., Oakland County, Hydrologic Unit 04090003, on left bank 100 ft upstream from railroad bridge, 1.6 mi southeast of Lake Orion, and 2.8 mi upstream from Trout Creek.	38.5	1955-75†, 1976-88	09-22-88	2.95	110
04161760	West Branch Stony Creek near Washington, MI	Lat 42°43'53", long 83°06'02", in SE1/4 sec.25, T.4 N., R.11 E., Oakland County, Hydrologic Unit 04090003, at Huron-Clinton Metropolitan Park Road, 3.4 mi west of Washington.	22.5	1965-88	03-13-88	2.25	23
04164010	North Branch Clinton River at Almont, MI	Lat 42°54'59", long 83°02'42", in NE1/4 sec.28, T.6 N., R.12 E., Lapeer County, Hydrologic Unit 04090003, at State Highway 53 in Almont.	9.56	1959-62, 1963-68†, 1969-88	12-20-87	<3.72	<167
04164050	North Branch Clinton River near Romeo, MI	Lat 42°49'11", long 82°58'35", in NW1/4 sec.31, T.5 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 33 Mile Road, 2.2 mi northeast of Romeo.	49.7	1959-64, 1965-69†, 1970-88	12-20-87	3.39	546
04164150	North Branch Clinton River near Meade, MI	Lat 42°43'50", long 82°54'23", in NE1/4 sec.34, T.4 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 27 Mile Road, 1.9 mi northwest of Meade.	89.6	1959-67, 1968-72†, 1973-88	12-21-87	5.81	784
04164200	Coon Creek near Armada, MI	Lat 42°47'41", long 82°52'58", in SW1/4 sec.1, T.4 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at North Road, 3.4 mi south of Armada.	10.0	1959-65, 1966-70†, 1971-88	12-20-87	5.03	127
04164350	Highbank Creek near Armada, MI	Lat 42°28'24", long 82°51'08", in NW1/4 sec.6, T.4 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 32 Mile Road, 3.0 mi southeast of Armada.	14.9	1959-65, 1965-70†, 1971-88	12-20-87	15.36	712
04164360	East Branch Coon Creek near New Haven, MI	Lat 42°45'46", long 82°50'57", in NW1/4 sec.19, T.4 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 29 Mile Road, 3.4 mi northwest of New Haven.	36.1	1959-67, 1968-72†, 1973-88	12-20-87	7.53	784
04164400	Deer Creek near Meade, MI	Lat 42°42'39", long 82°51'32", in NW1/4 sec.6, T.3 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 25 1/2 Mile Road, 0.9 mi southeast of Meade.	12.7	1959-60, 1960-65†, 1966-88	12-21-87	6.62	355
04164450	McBride Drain near Macomb, MI	Lat 42°41'14", long 82°55'14", in NE1/4 NE1/4 sec.16, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 24 Mile Road 2.2 mi southeast of Macomb.	5.79	1960-64†, 1965-88	12-21-87	6.67	112
04164600	Middle Branch Clinton River near Macomb, MI	Lat 42°42'03", long 82°59'44", in SE1/4 sec.2, T.3 N., R.12 E., Macomb County, Hydrologic Unit 04090003, at Schoenherr Road, 2.0 mi west of Macomb.	22.2	1959-64, 1965-69†, 1971-88	12-20-87	8.58	333
04164800	Middle Branch Clinton River at Macomb, MI	Lat 42°42'23", long 82°57'33", in SW1/4 sec.5, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at Romeo Plank Road, 0.4 mi north of Macomb.	41.0	1959-62, 1963-68†, 1969, 1970-82†, 1983-88	12-20-87	11.06	711
04165200	Gloede Ditch near Waldenburg, MI	Lat 42°37'39", long 82°57'10", in SW1/4 sec. 32, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, 2.2 mi south of Waldenburg.	16.0	1959, 1959-64†, 1965-88	12-21-87	14.70	231
		STREAMS TRIBUTARY TO DETROIT RIVER					
04168660	Frank and Poet Drain at Trenton, MI	Lat 42°09'19", long 83°12'22", in NW1/4 sec.13, T.4 S., R.10 E., Wayne County, Hydrologic Unit 04090004, at King Road in Trenton.	19.3	1972-88	12-16-87	8.33	316

See footnotes at end of table.

Annual maximum discharge at crest-stage partial-record stations during water year 1988--Continued

Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Annual Maximum Date	Annual Maximum Gage height (ft)	Annual Maximum Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE ERIE					
04168800	Huron River near Andersonville, MI	Lat 42°41'35", long 83°29'56", in NW1/4 SE1/4 sec.3, T.3 N., R.8 E., Oakland County, Hydrologic Unit 04090005, at White Lake Road, 2.5 mi south of Andersonville.	14.0	1974-88	12-20-87	<1.95	<58
04173250	Mill Creek near Lima Center, MI	Lat 42°15'56", long 83°56'45", in NE1/4 sec.34, T.2 S., R.4 E., Washtenaw County, Hydrologic Unit 04090005, at Guenther Road, 2.0 mi upstream from North Fork Mill Creek, and 2.2 mi south of Lima Center.	47.3	1973-88	04-07-88	7.72	288
04175960	South Branch River Raisin near Adrian, MI	Lat 41°55'03", long 84°00'37", in SE1/4 sec.25, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at Howell Highway, 2.0 mi northeast of Adrian.	165	1979-88	04-05-88	10.49	1,810
04176400	Saline River near Saline, MI	Lat 42°07'50", long 83°46'35", in SW1/4 sec.18, T.4 S., R.6 E., Washtenaw County, Hydrologic Unit 04100002, at Maple Road, 2.8 mi south of Saline.	94.6	1966-77†, 1978-88	04-06-88	10.77	1,070

† Operated as a continuous-record gaging station.
* Also a low-flow partial-record station.
a Estimated.
b Backwater from ice.
c Approximately.
d Maximum gage height, 7.20 ft, sometime prior to Feb. 25, backwater from ice.
e Maximum gage height, 4.73 ft, sometime prior to Jan. 14, backwater from ice.
f Revised.
g Maximum gage height, 4.34 ft, Jan. 9, backwater from ice.
h Maximum gage height, 5.00 ft, Feb. 1, backwater from ice.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Low-flow partial-record stations

Measurements of streamflow in the area covered by this report made at low-flow partial-record stations are given in the following table. These measurements were made during periods of base flow when streamflow is primarily from ground-water storage. These measurements, when correlated with the simultaneous discharge of a nearby stream where continuous records are available, will give a picture of the low-flow potentiality of a stream. The column headed "Period of record" shows the water years in which measurements were made at the same, or practically the same, site.

Discharge measurements made at low-flow partial-record stations during water year 1988

Station No.	Station Name	Location	Drainage area (mi²)	Period of record	Measurements Date	Measurements Discharge (ft³/s)
		STREAMS TRIBUTARY TO LAKE SUPERIOR				
04044400	Carp River near Negaunee, MI	Lat 46°31'29", long 87°34'25", in SE1/4 sec.29, T.48 N., R.26 W., Marquette County, Hydrologic Unit 04020105, at U.S. Highway 41, 2.0 mi northeast of Negaunee.	51.4	1961-86‡a, 1987-88a	06-15-88 07-27-88 08-24-88 09-06-88	b7.56 b4.91 b22.8 b33.1
		STREAMS TRIBUTARY TO LAKE MICHIGAN				
04057580	Whitefish River near Rapid River, MI	Lat 45°57'56", long 86°55'15", in SE1/4 NW1/4 sec.10, T.41 N., R.21 W., Delta County, Hydrologic Unit 04030111, about 800 ft downstream from Chippeny Creek, 3.5 mi northeast of Rapid River.	284	1973-88	05-05-88 06-09-88 09-02-88	263 93.3 103
04058120	Green Creek near Palmer, MI	Lat 46°22'22", long 87°36'21", in NW1/4 sec.19, T.46 N., R.26 W., Marquette County, Hydrologic Unit 04030110, at County Highway 565, 4.5 mi south of Palmer.	8.42	1961-65, 1970-88c	12-18-87 12-18-87 06-15-88 07-27-88 09-12-88 09-12-88	b10.4 b19.8 b4.02 b2.94 b28.0 b26.2
04059034	Escanaba River near Wells, MI	Lat 45°48'22", long 87°05'51", in SW1/4 NW1/4 sec.1, T.39 N., R.23 W., Delta County, Hydrologic Unit 04030110, 600 ft downstream from Bichler Creek, 2.0 mi northwest of Wells, and 2.5 mi upstream from mouth.	d920	1981-88c	12-30-87 05-04-88 06-07-88 09-27-88	b550 b788 b263 b630
04096517	South Branch Hog Creek Tributary near Allen, MI	Lat 41°57'33", long 84°49'33", in SW1/4 SW1/4 sec.7, T.6 S., R.4 W., Hillsdale County, Hydrologic Unit 04050001, at Squires Road, 0.3 mi upstream from mouth, and 3.0 mi west of Allen.	2.61	1969-88	10-20-87 05-17-88 06-27-88 08-08-88	5.24 1.00 1.14 1.17
04114594	Maple River near St. Johns, MI	Lat 43°02'43", long 84°28'11", in SE1/4 SE1/4 sec.30, T.8 N., R.1 W., Clinton County, Hydrologic Unit 04050005, at Colony Road, 4.5 mi northeast of St. Johns.	--	1981-88	10-06-87 05-06-88 06-22-88 09-14-88	26.4 67.5 15.3 13.0
*04120295	Black Creek near Muskegon, MI	Lat 43°12'14", long 86°09'52", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon, and 4.9 mi upstream from mouth.	d39	1974-88	11-19-87 03-29-88 05-17-88 08-30-88	43.3 b68.9 47.0 21.4
04121239	Clam River at Cadillac, MI	Lat 44°15'49", long 85°24'04", in NE1/4 NE1/4 sec.33, T.22 N., R.9 W., Wexford County, Hydrologic Unit 04060102, at Smith Street in Cadillac.	d48	1983-84, 1986-88	10-15-87 03-10-88 08-19-88 09-16-88	b40.5 47.4 3.04 2.90

‡ Operated as a continuous-record gaging station.
* Also a crest-stage partial-record station.
a Affected by domestic diversion.
b Not base flow.
c Affected by diversion for industrial use.
d Approximately.

Special study and miscellaneous sites

Discharge measurements in the following table were made at special study and miscellaneous sites throughout the State.

Discharge measurements made at special study and miscellaneous sites during water year 1988

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE SUPERIOR				
04028000	Montreal River	Lake Superior	Lat 46°27'00", long 90°10' 42", in SE1/4 SE1/4 sec.21, T.47 N., R.47 W., Gogebic County, Hydrologic Unit 04010302, at former gaging station, at Aurora Street in Ironwood.	63.0	1918-22†, 1924-26†, 1947, 1949-54†, 1967	07-18-88	*b9.56
04030000	Montreal River	Lake Superior	Lat 46°32'41", long 90°24'06", in SW1/4 NW1/4 sec.23, T.48 N., R.49 W., Michigan Meridian, Gogebic County, Hydrologic Unit 04010302, at former gaging station,2.0 mi upstream from mouth, and 3.5 mi north of Saxon, WI.	262	1938-70†, 1977	07-26-88	c117
04031500	Presque Isle River	Lake Superior	Lat 46°22'20", long 89°41'32", in SE1/4 NW1/4, sec.21, T.46 N., R.43 W., Gogebic County, Hydrologic Unit 04020101, at former gaging station, 0.3 mi upstream from highway bridge in Marenisco.	171	1945-82†	07-19-88	*b24.0
04034100	Bond Falls Lower By-Pass	Middle Branch Ontonagon River	Lat 46°24'27", long 89°07'44", in SE1/4 SW1/4 sec.1, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, at Bond Falls Road, 2.2 mi west of Calderwood.	--	1942,1945, 1963-64, 1967,1969, 1971-72, 1974, 1979-81, 1983-84, 1987	05-16-88	c27.5
04039900	West Branch Ontonagon River	Ontonagon River	Lat 46°41'12", long 89°13'47", in NW1/4 SE1/4 sec.31, T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, in concrete spill channel, 100 ft downstream from Victoria Dam, 0.8 mi south of Victoria.	--	--	06-22-88 06-22-88 06-22-88 06-22-88	c24.8 c75.7 c91.4 c108
			STREAMS TRIBUTARY TO LAKE MICHIGAN				
04057198	Fishdam River	Big Bay De Noc	Lat 45°54'31", long 96°34'02", in NE1/4 NW1/4 sec.33, T.41 N., R.18 W., Delta County, Hydrologic Unit 04030112, 1.0 mi upstream from mouth, and 2.0 mi northeast of Isabella.	--	--	08-10-87 11-02-87	22.2 *46.1
04057200	Fishdam River	Big Bay De Noc	Lat 45°54'09", long 86°34'39", in NE1/4 SE1/4 sec.32, T.41 N., R.18 W., Delta County, Hydrologic Unit 04030112, at U.S. Highway 2, 0.3 mi upstream from mouth, and 1.4 mi northeast of Isabella.	--	--	04-12-88	187
040575204	Sturgeon River	Big Bay De Noc	Lat 45°51'34", long 86°40'14", in NE1/4 SE1/4 sec.17, T.40 N., R.19 W., Delta County, Hydrologic Unit 04030112, 1.4 mi North of Nahma, and 3.1 mi upstream from mouth.	--	--	11-03-87	*146
040575205	Sturgeon River	Big Bay De Noc	Lat 45°51'22", long 86°40'20", in SW1/4 SE1/4 sec.17, T.40 N., R.19 W., Delta County, Hydrologic Unit 04030112, 1.2 mi north of Nahma, and 2.5 mi upstream from mouth.	--	--	08-10-87	99.3
040575208	Sturgeon River	Big Bay De Noc	Lat 45°50'27", long 86°40'07", in SE1/4 SE1/4 sec.20, T.40 N., R.19 W., Delta County, Hydrologic Unit 04030112, 0.2 mi upstream from mouth, and 0.3 mi west of Nahma.	--	--	04-12-88	809
04057604	Whitefish River	Little Bay De Noc	Lat 45°57'11", long 86°56'05", in NE1/4 NE1/4 sec.16, T.41 N., R.21 W., Delta County, Hydrologic Unit 04030111, 2.4 mi northeast of Rapid River, and 3.3 mi upstream from mouth.	307	--	08-11-87 11-03-87	127 *231

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04057610	Whitefish River	Little Bay De Noc	Lat 45°55'32", long 86°56'45", in NE1/4 NW1/4 sec.28, T.41 N., R.21 W., Delta County, Hydrologic Unit 04030111, at U.S. Highway 2, 0.9 mi upstream from mouth, and 1.0 mi east of Rapid River.	--	1950d, 1976d, 1978d	04-12-88	1,380
04057650	Rapid River	Little Bay De Noc	Lat 45°55'37", long 86°57'48", in NE1/4 NW1/4 sec.29, T.41 N., R.21 W., Delta County, Hydrologic Unit 04030111, at U.S. Highway 2 in Rapid River.	144	1949-50	08-11-87 11-03-87 04-13-88	66.2 *90.8 418
04057663	Days River	Little Bay De Noc	Lat 45°53'43", long 86°59'33", in NW1/4 NW1/4 sec.2, T.40 N., R.22 W., Delta County, Hydrologic Unit 04030111, at Bay Shore Drive, 1.8 mi northeast of Kipling.	70.0	1967, 1969-70, 1975-76	08-11-87 11-02-87 04-11-88	31.2 *26.7 216
04059510	Ford River	Green Bay	Lat 45°40'39", long 87°08'33", in NE1/4 NE1/4 sec.21, T.38 N., R.23 W., Delta County, Hydrologic Unit 04030109, at State Highway 35 in Ford River.	--	--	08-11-87 11-03-87	166 *217
04059754	Cedar River	Green Bay	Lat 45°26'18", long 87°21'36", in NE1/4 SW1/4 sec.11, T.35 N., R.25 W., Menominee County, Hydrologic Unit 04030109, 1.9 mi north of Cedar River, and 2.4 mi upstream from mouth.	--	--	08-12-87 11-04-87	73.5 156
04059762	Cedar River	Green Bay	Lat 45°24'51", long 87°21'01", in SE1/4 NE1/4 sec.23, T.35 N., R.25 W., Menominee County, Hydrologic Unit 04030109, at State Highway 35 in Cedar River.	--	--	04-11-88	1,670
04065110	Menominee River	Lake Michigan	Lat 45°45'53", long 87°58'00", in NE1/4 sec.23, T.39 N., R.30 W., Dickinson County, Hydrologic Unit 04030108, at intake at Champion International Corp. Quinnesec Pulpmill, 2.0 mi southeast of Niagara, WI.	2,470	1987	11-12-87 12-17-87 03-17-88 04-11-88 06-01-88 06-07-88 06-15-88 08-04-88 09-20-88	c1,490 c2,210 c1,3[illegible] c3,740 c1,090 c866 c948 c876 c1,350
[illegible]	Unnamed tributary	Nottawa Creek	Lat 42°1[illegible], long [illegible]40", in SE1/4 [illegible] County, Hydrologic Unit 04050001, at 14 1/2 Mile Road, 5.0 mi north of Tekonsha.	--	--	[illegible]	[illegible]
04097525	Prairie River	St. Joseph River	Lat 41°48'07", long 85°07'00", in NE1/4 SE1/4 sec.4, T.8 S., R.7 W., Branch County, Hydrologic Unit 04050001, at Bowers Road, 2.0 mi east of Gilead.	27.3	1964, 1965	07-08-88	*b5.11
04097526	Prairie River	St. Joseph River	Lat 41°49'57", long 85°09'54", in NW1/4 SE1/4 sec.30, T.7 S., R.7 W., Branch County, Hydrologic Unit 04050001, at Parnam Road, 2.0 mi north of Gilead.	31.9	1964, 1965	07-08-88	*b3.85
04097528	Prairie River	St. Joseph River	Lat 41°50'22", long 85°11'40", in NW1/4 NW1/4 sec.25, T.7 S., R.8 W., Branch County, Hydrologic Unit 04050001, at Orland Road, 2.3 mi south of Bronson.	42.5	1963-66	07-08-88	*b1.65
04101532	Dowagiac River	St. Joseph River	Lat 42°02'59", long 86°04'10", in SW1/4 NW1/4 sec.9, T.5 S., R.15 W., Cass County, Hydrologic Unit 04050001, at Atwood Road, 5.0 mi northeast of Dowagiac.	--	--	07-11-88	b22.5
04101545	Dowagiac River	St. Joseph River	Lat 42°00'32", long 86°08'43", in SW1/4 NW1/4 sec.26, T.5 S., R.16 W., Cass County, Hydrologic Unit 04050001, at Middle Crossing Road, 2.8 mi northwest of Dowagiac.	--	--	07-11-88	b48.6

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04101650	Dowagiac River	St. Joseph River	Lat 41°56'44", long 86°11'23", in NW1/4 SE1/4 sec.17, T.6 S., R.16 W., Cass County, Hydrologic Unit 04050001, at Sink Road, 2.5 mi northeast of Sumnerville.	--	--	07-11-88	b99.3
04102705	South Branch Black River	Black River	Lat 42°21'38", long 86°11'32", in NW1/4 NE1/4 sec.29, T.1 S., R.16 W., Van Buren County, Hydrologic Unit 04050002, at 16th Avenue, 5.0 mi southeast of South Haven.	86.0	1962-64	09-02-88	*b25.4
04102720	Cedar Creek	South Branch Black River	Lat 42°21'15", long 86°11'17", in NW1/4 NW1/4 sec.29, T.1 S., R.16 W., Van Buren County, Hydrologic Unit 04050002, at 16th Avenue, 4.8 mi southeast of South Haven.	17.6	1962-64, 1980-82	06-22-88	*b1.91
04102774	Scott Creek	Middle Branch Black River	Lat 42°28'48", long 86°07'45", in SE1/4 SE1/4 sec.12, T.1 N., R.16 W., Allegan County, Hydrologic Unit 04050002, at 60th Street, 2.0 mi west of Pullman.	--	--	06-22-88 09-02-88	*b3.98 *b2.03
04102777	Middle Branch Black River	Black River	Lat 42°25'48", long 86°13'35", in NE1/4 NE1/4 sec.31, T.1 N., R.16 W., Allegan County, Hydrologic Unit 04050002 at 70th Street, 3.0 mi northeast of South Haven.	--	--	06-22-88 09-02-88	*b31.7 *b19.8
04102779	North Branch Black River	Middle Branch Black River	Lat 42°26'11", long 86°13'52", in SE1/4 SE1/4 sec.30, T.1 N., R.16 W., Allegan County, Hydrologic Unit 04050002, at 103rd Avenue, 3.1 mi northeast of South Haven.	--	--	06-22-88 09-02-88	*b14.0 *b9.63
04102786	South Branch Kalamazoo River	Kalamazoo River	Lat 42°04'35", long 84°35'34", in NE1/4 SE1/4 sec.36, T.4 S., R.3 W., Jackson County, Hydrologic Unit 04050003, at Grover Road, 2.7 mi southwest of Hanover.	--	--	08-03-88	*b0.96
04102850	South Branch Kalamazoo River	Kalamazoo River	Lat 42°12'11", long 84°47'39", in SE1/4 SE1/4 sec.17, T.3 S., R.4 W., Calhoun County, Hydrologic Unit 04050003, at former gaging station, at F Drive South, 3.6 mi southwest of Albion.	146	1972-76‡	08-03-88	*b41.4
04102980	North Branch Kalamazoo River	Kalamazoo River	Lat 42°12'51", long 84°39'55", in NW1/4 NE1/4 sec.16, T.3 S., R.3 W., Jackson County, Hydrologic Unit 04050003, at King Road, 2.8 mi north of Concord.	--	--	08-03-88	*b18.4
04103470	Rice Creek	Kalamazoo River	Lat 42°17'32", long 84°54'25", in SE1/4 SE1/4 sec.17, T.2 S., R.5 W., Calhoun County, Hydrologic Unit 04050003, at 20 Mile Road, 2.2 mi northeast of Marshall.	--	1983	08-03-88	*b20.8
04103500	Kalamazoo River	Lake Michigan	Lat 42°15'55", long 84°57'55", in SE1/4 SE1/4 sec.26, T.2 S., R.6 W., Calhoun County, Hydrologic Unit 04050003, at former gaging station, at South Kalamazoo Avenue in Marshall.	449	1939-82‡	05-05-88 08-03-88	*b279 *b64.4
04103997	Battle Creek	Kalamazoo River	Lat 42°32'40", long 84°50'09", in NE1/4 SE1/4 sec.24, T.2 N., R.5 W., Eaton County, Hydrologic Unit 04050003, at Cochran Road in Charlotte.	--	--	08-03-88	*b5.2[illegible]
04104500	Battle Creek	Kalamazoo River	Lat 42°26'35", long 85°02'00", in SW1/4 NW1/4 sec.28, T.1 N., R.6 W., Eaton County, Hydrologic Unit 04050003, at former gaging station, at State Highway 78 in Bellevue.	178	1948-53‡, 1977	08-03-88	*b44.5
04105585	Wabaseon Creek	Kalamazoo River	Lat 42°23'03", long 85°14'30", in SE1/4 NE1/4 sec.16, T.1 S., R.8 W., Calhoun County, Hydrologic Unit 04050003, at S Drive North, 2.0 mi north of Battle Creek.	--	--	08-02-88	*b5.79

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--continued				
04105645	Sevenmile Creek	Kalamazoo River	Lat 42°23'28", long 85°16'48", in NE1/4 NE1/4 sec.18, T.1 S., R.8 W., Calhoun County, Hydrologic Unit 04050003, at One Mile Road, 2.8 mi northwest of Oak Park.	--	--	08-02-88	*b4.66
04106750	Spring Brook	Kalamazoo River	Lat 42°21'24", long 85°33'05", in SW1/4 NW1/4 sec.25, T.1 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, at Riverview Drive, 0.6 mi north of East Cooper.	31.1	1942, 1964-71, 1984, 1986-87	08-02-88	*b14.8
04107215	Gun River	Kalamazoo River	Lat 42°32'17", long 85°33'47", in SE1/4 SE1/4 sec.23, T.2 N., R.11 W., Allegan County, Hydrologic Unit 04050003, at 116th Avenue, 4.0 mi east of Martin.	73.3	1964-65, 1986-87	09-13-88	*b23.4
04107220	Gun River	Kalamazoo River	Lat 42°30'56", long 85°33'46", in NW1/4 SW1/4 sec.36, T.2 N., R.11 W., Allegan County, Hydrologic Unit 04050003, at 2nd Street, 0.5 mi north of Hooper.	--	1986-87	09-13-88	*b28.3
04107223	Gun River	Kalamazoo River	Lat 42°30'34", long 85°33'36", in SW1/4 SW1/4 sec.36, T.2 N., R.11 W., Allegan County, Hydrologic Unit 04050003, at 112th Avenue in Hooper.	--	1986-87	09-13-88	*b33.4
04107225	Gun River	Kalamazoo River	Lat 42°29'38", long 85°35'03", in SE1/4 SE1/4 sec.3, T.1 N., R.11 W., Allegan County, Hydrologic Unit 04050003, at 110th Avenue, 5.0 mi northeast of Plainwell.	--	1986-87	08-02-88 09-13-88	*b17.6 *b38.7
04107228	Gun River	Kalamazoo River	Lat 42°28'40", long 85°36'44", in NW1/4 NE1/4 sec.16, T.1 N., R.11 W., Allegan County, Hydrologic Unit 04050003, at 7th Street, 3.0 mi northeast of Plainwell.	--	1986-87	09-13-88	*b41.9
04107233	Gun River	Kalamazoo River	Lat 42°28'18", long 85°39'03", in SW1/4 NE1/4 sec.18, T.1 N., R.11 W., Allegan County, Hydrologic Unit 04050003, at 107th Avenue, 2.0 mi north of Plainwell.	--	1986-87	09-13-88	*b46.4
04107800	Schnable Brook	Kalamazoo River	Lat 42°30'00", long 85°45'36", in NE1/4 SE1/4 sec.6, T.1 N., R.12 W., Allegan County, Hydrologic Unit 04050003, at 22nd Street, 4.2 mi northwest of Otsego.	--	--	08-02-88	*b3.84
04108415	Sand Creek	Kalamazoo River	Lat 42°35'37", long 85°56'37", in SW1/4 SE1/4 sec.34, T.3 N., R.14 W., Allegan County, Hydrologic Unit 04050003, at State Highway 89, 2.3 mi northwest of Millgrove.	--	--	08-15-88	b0.00
04108575	Rabbit River	Kalamazoo River	Lat 42°40'27", long 85°34'45", in SW1/4 NW1/4 sec.2, T.3 N., R.11 W., Allegan County, Hydrologic Unit 04050003, at 135th Avenue, 3.2 mi east of Wayland.	--	--	08-02-88	*b5.40
04108625	Rabbit River	Kalamazoo River	Lat 42°42'06", long 85°53'55", in NW1/4 SW1/4 sec.30, T.4 N., R.13 W., Allegan County, Hydrologic Unit 04050003, at 36th Street, 1.2 mi southeast of Bentheim.	--	--	08-02-88	*b51.0
04108628	Black Creek	Rabbit River	Lat 42°42'34", long 85°53'55", in SW1/4 SW1/4 sec.19, T.4 N., R.13 W., Allegan County, Hydrologic Unit 04050003, at 140th Avenue, 1.0 mi east of Bentheim.	--	--	08-02-88	*b3.48
04108804	North Branch Macatawa River	Macatawa River	Lat 42°46'33", long 86°03'42", in SE1/4 NE1/4 sec.34, T.5 N., R.15 W., Ottawa County, Hydrologic Unit 04050002, at Mason Street, 0.5 mi east of Holland.	--	--	07-07-88	b0.00
04108995	Hurd Marvin Drain	Grand River	Lat 42°16'59", long 84°24'52", in NE1/4 SW1/4 sec.22, T.2 S., R.1 W., Jackson County, Hydrologic Unit 04050004, at Penn Central Railroad Bridge, 1.0 mi north of Jackson.	--	--	07-11-88	*b0.43

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04110000	Orchard Creek	Portage Creek	Lat 42°23'35", long 84°15'50", in SE1/4 SW1/4 sec.12, T.1 S., R.1 E., Jackson County, Hydrologic Unit 04050004, at former gaging station, at State Highway 106, 0.5 mi west of Munith.	849	1944-56‡, 1957	07-11-88	*b3.94
04110500	Portage River	Grand River	Lat 42°20'59", long 84°15'48", in SE1/4 SW1/4 sec.25, T.1 S., R.1 E., Jackson County, Hydrologic Unit 04050004, at former gaging station, Dunn Road, 3.0 mi south of Munith.	118	1944-46‡, 1947-48, 1950	07-11-88	*b5.81
04110620	Portage River	Grand River	Lat 42°18'43", long 84°23'14", in NE1/4 SE1/4 sec.11, T.2 S., R.1 W., Jackson County, Hydrologic Unit 04050004, at State Highway 106, 4.0 mi northeast of Jackson.	--	--	07-11-88	*b1.80
04111000	Grand River	Lake Michigan	Lat 42°32'05", long 84°37'25", in NE1/4 NE1/4 sec.26, T.2 N., R.3 W., Eaton County, Hydrologic Unit 04050004, at former gaging station, at Petrieville Highway, 2.0 mi northeast of Eaton Rapids.	661	1951-82‡	07-11-88	*b57.0
04112850	Sycamore Creek	Red Cedar River	Lat 42°38'25", long 84°28'58", in SW1/4 SW1/4 sec.18, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at former gaging station, at Holt Road, 1.5 mi east of Holt.	80.6	1973, 1975, 1975-80‡	07-11-88	*b4.72
04115170	Fish Creek	Maple River	Lat 43°18'28", long 84°56'15", in SW1/4 SE1/4 sec.25, T.11 N., R.6 W., Montcalm County, Hydrologic Unit 04050005, at Klees Road, 4.0 mi southeast of McBrides.	--	1985	07-06-88	*b3.57
04115200	Fish Creek	Maple River	Lat 43°16'44", long 84°58'26", in NW1/4 NW1/4 sec.12, T.10 N., R.6 W., Montcalm County, Hydrologic Unit 04050005, at Pakes Road, 3.5 mi northwest of Crystal.	27.8	1985	07-06-88	*b5.60
04115290	West Branch Fish Creek	Fish Creek	Lat 43°14'33", long 84°45'04", in SW1/4 NW1/4 sec.22, T.10 N., R.6 W., Montcalm County, Hydrologic Unit 04050005, at Townhall Road, 5.1 mi west of Crystal.	--	1983	07-06-88	*b3.86
04115320	Fish Creek	Maple River	Lat 43°12'23", long 84°52'33", in NW1/4 NE1/4 sec.2, T.9 N., R.5 W., Montcalm County, Hydrologic Unit 04050005, at Condensery Road, 2.0 mi north of Carson City.	--	1983	07-06-88	*b16.4
04115515	Fish Creek	Maple River	Lat 43°08'53", long 84°51'30", in SE1/4 SE1/4 sec.23, T.9 N., R.5 W., Montcalm County, Hydrologic Unit 04050005, at Fenwick Road, 2.0 mi south of Carson City.	145	1955, 1960-61	07-06-88	*b19.3
04116505	Flat River	Grand River	Lat 43°03'10", long 85°15'50", in SE1/4 NW1/4 sec.28, T.8 N., R.8 W., Ionia County, Hydrologic Unit 04050006, at former gaging station, at Ingalls Road, 0.5 mi south of Smyrna.	528	1951-86‡	07-06-88	*b174
04117400	Cedar Creek	Thornapple River	Lat 42°34'15", long 85°15'41", in NE1/4 SW1/4 sec.9, T.2 N., R.8 W., Barry County, Hydrologic Unit 04050007, at State Highway 37, 3.3 mi north of Dowling.	--	1964	10-08-87	*b23.3
04117420	Cedar Creek	Thornapple River	Lat 42°35'29", long 85°15'14", in SE1/4 NE1/4 sec.4, T.2 N., R. 8 W., Barry County, Hydrologic Unit 04050007, at McGlynn Road, 3.0 mi southeast of Hastings.	--	--	10-08-87	*b29.4

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04117430	North Branch Cedar Creek	Cedar Creek	Lat 42°35'36", long 85°16'03", in NW1/4 NW1/4 sec.4, T.2 N., R.8 W., Barry County, Hydrologic Unit 04050007, at State Highway 37, 2.5 mi south of Hastings	--	--	10-08-87	*b2.57
04117450	Cedar Creek	Thornapple River	Lat 42°36'37", long 85°13'53", in NW1/4 NW1/4 sec.35, T.3 N., R.8 W., Barry County, Hydrologic Unit 04050007, at State Highway 79, 0.3 mi west of Quimby.	--	1964	10-08-87	*b32.4
04118400	Rogue River	Grand River	Lat 43°09'38", long 85°41'23", in NW1/4 NW1/4 sec.24, T.9 N., R.12 W., Kent County, Hydrologic Unit 04050006, at 13 Mile Road, 1.1 mi east of Sparta.	155	1963-65	07-06-88	*b36.5
04121430	Whetstone Creek	Muskegon River	Lat 44°00'57", long 85°11'21", in NE1/4 NE1/4 sec.30, T.19 N., R.7 W., Osceola County, Hydrologic Unit 04060102, at 14 Mile Road, 1.9 mi east of Avondale.	--	--	07-25-88	b0.00
04126200	Little Manistee River	Manistee Lake	Lat 44°11'00", long 86°10'00", in NE1/4 NE1/4 sec.31, T.21 N., R.15 W., Manistee County, Hydrologic Unit 04060103, at former gaging station, at Six Mile Bridge, 5.8 mi north of Freesoil.	178	1957-75‡, 1978-80e, 1976-82f	08-31-88	*156
04126645	Platte River	Lake Michigan	Lat 44°41'13", long 85°50'16", in NW1/4 NW1/4 sec.1, T.26 N., R.13 W., Benzie County, Hydrologic Unit 04060104, at County Road 665, 2.6 mi south of Lake Ann.	--	1987	11-09-87 04-05-88 08-03-88	b5.88 b21.1 *b5.96
04126650	Unnamed tributary	Lake Ann	Lat 44°42'50", long 85°50'18", in SE1/4 NE1/4 sec.26, T.27 N., R.13 W., Benzie County, Hydrologic Unit 04060104, at County Road 665, 0.8 mi south of Lake Ann.	4.78	1958, 1987	11-09-87 04-05-88 08-03-88	b8.46 b15.6 *b5.16
04126653	Platte River	Lake Michigan	Lat 44°42'31", long 85°51'17", in NW1/4 SW1/4 sec.26, T.27 N., R.13 W., Benzie County, Hydrologic Unit 04060104, at Birchview Trail, 1.1 mi southwest of Lake Ann.	--	1987	11-09-87 04-05-88 08-03-88	b79.2 b57.5 *b23.4
04126664	Platte River	Lake Michigan	Lat 44°39'56", long 85°55'59", in NE1/4 SW1/4 sec.7, T.26 N., R.13 W., Benzie County, Hydrologic Unit 04060104, 200 ft upstream of Brundage Creek, upstream of State Fish Hatchery, 4.0 mi east of Honor.	--	1975 1987	11-09-87 04-05-88 05-10-88 08-03-88	b60.9 b92.4 b74.5 *b53.7
04126700	Platt River	Lake Michigan	Lat 44°39'36", long 85°56'36", in SW1/4 SE1/4 sec.12, T.26 N., R.14 W., Benzie County, Hydrologic Unit 04060104, at U.S. Highway 31, 4.0 mi east of Honor.	91.9	1958, 1960-69, 1980-81, 1987	04-05-88 05-10-88 08-03-88	b124 b102 *b73.1
04126742	Platte River	Lake Michigan	Lat 44°40'17", long 86°02'12", in NW1/4 NW1/4 sec.8, T.26 N., R.14 W., Benzie County, Hydrologic Unit 04060104, at Indian Hill Road, 1.0 mi northwest of Honor.	118	1958, 1968, 1980-81, 1987	11-10-87 04-05-88 05-09-88 08-03-88	b128 b171 b139 *b117
04126751	North Branch Platte River	Platte River	Lat 44°41'01", long 86°03'30", in SE1/4 NE1/4 sec.1, T.26 N., R.15 W., Benzie County, Hydrologic Unit 04060104, at Deadstream Road, 2.5 mi northwest of Honor.	31.1	1958, 1980-81, 1987	11-10-87 04-05-88 05-09-88 08-03-88	b36.6 b46.1 b21.8 *b13.4
04126755	Platte River	Lake Michigan	Lat 44°42'39", long 86°07'08", in NE1/4 SE1/4 sec.28, T.27 N., R.15 W., Benzie County, Hydrologic Unit 04060104, at State Highway 22, 6.2 mi northwest of Honor.	166	1946-48, 1958, 1979-82, 1987	11-10-87 03-14-88 04-05-88 05-09-88 08-03-88	b177 b166 b232 b187 *b124
04126800	Crystal River	Lake Michigan	Lat 44°54'00", long 85°57'15", in NW1/4 SW1/4 sec.24, T.29 N., R.14 W., Leelanau County, Hydrologic Unit 04060104, 0.7 mi downstream from Glen Lake, and 1.8 mi east of Glen Arbor.	--	1946-51	08-02-88	*b20.5

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^{2})	Measured previously (water years)	Measurements	
						Date	Discharge (ft^{3}/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04126802	Crystal River	Lake Michigan	Lat 44°54'10", long 85°57'46", in SE1/4 NE1/4 sec.23, T.29 N., R.14 W., Leelanau County, Hydrologic Unit 04060104, at County Road 675, 1.4 mi east of Glen Arbor.	42.0	1979-82	08-02-88	*b24.7
04126805	Crystal River	Lake Michigan	Lat 44°54'18", long 85°58'30", in SW1/4 NW1/4 sec.23, T.29 N., R.14 W., Leelanau County, Hydrologic Unit 04060104, at State Highway 22, 0.9 mi northeast of Glen Arbor.	--	--	08-02-88	*b22.0
			STREAMS TRIBUTARY TO LAKE HURON				
04127884	St. Marys River Power Canal	St. Marys River	Lat 46°29'39", long 84°20'50", in SE1/4 SE1/4 sec.6, T.47 N., R.1 E., Chippewa County, Hydrologic Unit 04070001, at Bingham Street in Sault Ste. Marie.	--	--	10-20-87	c28,900
04128850	Pigeon River	Mullett Lake	Lat 45°02'56", long 84°34'19", in NE1/4 SE1/4 sec.29, T.31 N., R.2 W., Otsego County, Hydrologic Unit 04070004, at Whitehouse Road, 0.5 mi north of Sparr.	14.0	1966	01-27-88	*b18.8
04132400	Thunder Bay River	Lake Huron	Lat 44°58'19", long 84°01'56", in SW1/4 SW1/4 sec.24, T.30 N., R.3 E., Montmorency County, Hydrologic Unit 04070006, at State Highway 33, 6.0 mi southeast of Atlanta.	--	--	08-15-88	b205
04133000	Upper South Branch Thunder Bay River	Thunder Bay River	Lat 45°03'30", long 83°47'00", in NE1/4 NE1/4 sec.26, T.31 N., R.5 E., Alpena County, Hydrologic Unit 04070006, at former gaging station, at State Highway 32, 3.5 mi southwest of Lachine.	171	1945-54†, 1968-70, 1981	08-15-88	b64.4
04134650	Wolf Creek	Lower South Branch Thunder Bay River	Lat 44°55'54", long 83°38'42", in NW1/4 NW1/4 sec.7, T.29 N., R.7 E., Alpena County, Hydrologic Unit 04070006, at Beaver Lake Road, 4.9 mi northwest of Hubbard Lake.	--	--	08-16-88	b122
04134750	Lower South Branch Thunder Bay River	Thunder Bay River	Lat 45°01'10", long 83°33'35" in NE1/4 NW1/4 sec.11, T.30 N., R.7 E., Alpena County, Hydrologic Unit 04070006, at State Forest Campground, 2.8 mi southeast of McHarg.	--	--	08-16-88	b146
04138000	East Branch Au Gres River	Lake Huron	Lat 44°14'03", long 83°42'03", in NW1/4 NW1/4 sec.10, T.21 N., R.6 E., Iosco County, Hydrologic Unit 04080101, at former gaging station, at Whittemore Road, 0.9 mi west of McIvor.	a84	1951-74†, 1975-82†, 1984	06-27-88	*b30.8
04138500	Au Gres River	Lake Huron	Lat 44°10'26", long 83°44'36", in NE1/4 NE1/4 sec.31, T.21 N., R.6 E., Iosco County, Hydrologic Unit 04080101, at former gaging station, at Allen Road, 4.4 mi southwest of National City.	154	1951-81†, 1984	06-27-88 07-19-88	*b15.0 *19.6
04143350	Watson Drain	North Branch Kawkawlin River	Lat 43°51'18", long 84°10'44", in NE1/4 NW1/4 sec.25, T.17 N., R.2 E., Gladwin County, Hydrologic Unit 04080102, at Pinconning Road, 1.7 mi southeast of Estey.	--	--	07-14-88	b0.00
04143400	Kawkawlin Creek	North Branch Kawkawlin River	Lat 43°47'32", long 84°13'38", in SE1/4 NE1/4 sec.16, T.16 N., R.2 E., Midland County, Hydrologic Unit 04080102, at Jefferson Road, 8.0 mi east of Edenville.	--	--	07-14-88	b0.00
04143410	Herner Drain	Kawkawlin Creek	Lat 43°49'24", long 84°13'38", in SW1/4 NW1/4 sec.3, T.16 N., R.2 E., Midland County, Hydrologic Unit 04080102, at Jefferson Road, 8.0 mi east of Edenville.	--	--	07-14-88	b0.00

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements Date	Measurements Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE HURON--Continued				
04143500	North Branch Kawkawlin River	Kawkawlin River	Lat 43°40'05", long 83°58'13", in SE1/4 SE1/4 sec.27, T.15 N., R.4 E., Bay County, Hydrologic Unit 04080102, at former gaging station, at Beaver Road, 1.7 mi northwest of Kawkawlin.	101	1951-82‡, 1985	07-07-88	0.00
04145500	Bad River	Shiawassee River	Lat 43°17'48", long 84°13'45", in SW1/4 NW1/4 sec.3, T.10 N., R.2 E., Saginaw County, Hydrologic Unit 04080203, at former gaging station, at Hemlock Road, 2.5 mi north of Brant.	489	1949-59‡, 1961-68f, 1980-82	06-22-88 07-04-88	b0.00 b0.00
04145785	Swan Creek	Marsh Creek	Lat 43°27'08", long 84°07'13", in SW1/4 SE1/4 sec.9, T.12 N., R.3 E., Saginaw County, Hydrologic Unit 04080203, at Frost Road, 0.1 mi east of Frost.	--	--	06-22-88	*b0.47
04145790	McClellan Run	Swan Creek	Lat 43°26'06", long 84°09'03", in NW1/4 NW1/4 sec.20, T.12 N., R.3 E., Saginaw County, Hydrologic Unit 04080203, at Gleaner Road, 4.2 mi northeast of Hemlock.	--	1981	06-22-88	*b0.46
04145792	Gleaner Drain	Williams Creek	Lat 43°24'21", long 84°08'25", in NW1/4 NE1/4 sec.32, T.12 N., R.3 E., Saginaw County, Hydrologic Unit 04080203, at Schomaker Road, 3.5 mi northwest of Swan Creek.	--	--	06-22-88	b0.00
04145793	Williams Creek	Swan Creek	Lat 43°24'28", long 84°07'52", in NW1/4 NW1/4 sec.33, T.12 N., R.3 E., Saginaw County, Hydrologic Unit 04080203, at State Highway 52, 2.8 mi northwest of Swan Creek.	--	1972	06-22-88	*b0.17
04148410	Thread Creek	Swartz Creek	Lat 42°55'28", long 83°34'14", in SW1/4 NW1/4 sec.18, T.6 N., R.8 E., Genesee County, Hydrologic Unit 04080204, at Burpee Road, 2.7 mi east of Grand Blanc.	--	--	07-14-88	b0.00
04148440	Thread Creek	Swartz Creek	Lat 42°58'30", long 83°38'09", in SE1/4 SE1/4 sec.28, T.7 N., R.7 E., Genesee County, Hydrologic Unit 04080204, at former gaging station, at Bristol Road, 4.0 mi southeast of Flint.	54.4	1970-84‡	06-30-88	b0.00
04152030	East Branch Tittabawassee River	Middle Branch Tittabawassee River	Lat 44°07'44", long 84°13'41", in SE1/4 SE1/4 sec.15, T.20 N., R.2 E., Gladwin County, Hydrologic Unit 04080201, at Herner Road, 10 mi south of West Branch.	--	1958, 1984	06-27-88	*b8.17
04152057	Sugar River	Tittabawassee River	Lat 44°02'03", long 84°22'02", in SE1/4 SE1/4 sec.13, T.19 N., R.1 W., Gladwin County, Hydrologic Unit 04080201, at State Highway 30, 7.0 mi northeast of Gladwin.	70.3	1960, 1984	06-27-88	*b11.1
04152070	Molasses River	Tittabawassee River	Lat 43°58'42", long 84°16'37", in SE1/4 NW1/4 sec.7, T.18 N., R.2 E., Gladwin County, Hydrologic Unit 04080201, at State Highway 61, 10.5 mi east of Gladwin.	46.0	1958, 1984	06-27-88	*b1.71
04152078	Lorraby Creek	Tittabawassee River	Lat 43°54'12", long 84°19'38", in SE1/4 SE1/4 sec.3, T.17 N., R.1 E, Gladwin County, Hydrologic Unit 04080201, at Wieman Road, 3.4 mi southeast of Winegars.	11.2	1984	06-27-88	*b0.10
04152290	Middle Branch Tobacco River	Tobacco River	Lat 43°53'20", long 84°31'30", in SW1/4 SW1/4 sec.2, T.17 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, at McCulloch Road, 2.0 mi west of Beaverton.	33.8	1958-63, 1966-67, 1976	06-15-88	*b17.3
04152360	North Branch Tobacco River	Tobacco River	Lat 43°55'27", long 84°35'07", in SE1/4 NE1/4 sec.30, T.18 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, at Bard Road, 5.8 mi northwest of Beaverton.	59.4	1958-59, 1964-65	06-15-88	*b26.5

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE HURON--Continued				
04152430	Cedar River	Tobacco River	Lat 43°58'60", long 84°29'46", in NE1/4 SW1/4 sec.1, T.18 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, at State Highway 61, in Gladwin.	--	1976	06-15-88 06-28-88 07-12-88 08-02-88	*b55.3 *b53.2 b61.1 *b32.4
04152435	Lucas Drain	Cedar River	Lat 43°57'41", long 84°29'22", in SE1/4 SE1/4 sec.12, T.18 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, at mouth, 1.3 mi south of Gladwin.	--	--	06-28-88 08-02-88	*b0.22 *b0.31
04152440	Cannon Drain	Cedar River	Lat 43°57'07", long 84°29'07", in SW1/4 NW1/4 sec.18, T.18 N., R.1 W., Gladwin County, Hydrologic Unit 04080201, at mouth, 2.0 mi south of Gladwin.	--	--	06-28-88 08-02-88	b0.00 b0.00
04152445	Farm Drain	Cedar River	Lat 43°56'59", long 84°29'11", in NE1/4 SE1/4 sec.13, T.18 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, at mouth, 2.2 mi south of Gladwin.	--	--	06-28-88	b0.00
04152450	Cedar River	Tobacco River	Lat 43°54'56", long 84°28'44", in NE1/4 NW1/4 sec.31, T.18 N., R.1 W., Gladwin County, Hydrologic Unit 04080201, at Howard Road, 2.3 mi north of Beaverton.	140	1967, 1976	06-28-88 07-12-88 08-02-88	*b58.4 b66.7 *b36.8
04152500	Tobacco River	Tittabawassee River	Lat 43°52'43", long 84°28'18", in NW1/4 SE1/4 sec.7, T.17 N., R.1 W., Gladwin County, Hydrologic Unit 04080201, at former gaging station, at Glidden Road in Beaverton.	487	1948-67, 1984	06-15-88	*b144
04152585	Chris Smith Drain	Little Cedar River	Lat 43°52'46", long 84°24'21", in SW1/4 NW1/4 sec.11, T.17 N., R.1 W., Gladwin County, Hydrologic Unit 04080201, at Shaffer Road, 4.0 mi east of Beaverton.	--	--	07-19-88	b0.00
04152590	Little Cedar River	Tobacco River	Lat 43°52'19", long 84°24'35", in SE1/4 SE1/4 sec.10, T.17 N., R.1 W., Gladwin County, Hydrologic Unit 04080201, at Van Dyke Road, 3.8 mi east of Beaverton.	--	--	07-19-88	b0.00
04152595	Dow Creek	Little Cedar River	Lat 43°52'19", long 84°25'00", in NE1/4 NW1/4 sec.15, T.17 N., R.1 W., Gladwin County, Hydrologic Unit 04080201, at Van Dyke Road, 3.5 mi east of Beaverton.	--	--	07-19-88	b0.00
04152600	Little Cedar River	Tobacco River	Lat 43°51'27", long 84°24'16", in SW1/4 SW1/4 sec.14, T.17 N., R.1 W., Gladwin County, Hydrologic Unit 04080201, at Dale Road, 1.6 mi east of Dale.	24.4	1984	07-19-88	b0.00
04153520	Visgar Drain	Sturgeon Creek	Lat 43°42'46", long 84°16'38", in SE1/4 SW1/4 sec.7, T.15 N., R.2 E., Midland County, Hydrologic Unit 04080201, at Mier Road, 1.5 mi southwest of Larkin.	--	--	07-27-88	b0.00
04153525	Visgar Drain	Sturgeon Creek	Lat 43°41'53", long 84°16'01", in NW1/4 NW1/4 sec.20, T.15 N., R.2 E., Midland County, Hydrologic Unit 04080201, at Blackhurst Road, 1.6 mi southwest of Larkin.	--	--	07-27-88	b0.00
04155005	Pine River	Chippewa River	Lat 43°24'42", long 84°36'27", in SW1/4 SW1/4 sec.19, T.12 N., R.12 W., Gratiot County, Hydrologic Unit 04080202, downstream of high school foot bridge in St. Louis.	--	1974, 1987	10-05-87 06-28-88	bc192 bc8.73
04159012	Pinnebog River	Lake Huron	Lat 43°50'53", long 83°09'44", in NE1/4 NE1/4 sec.3, T.16 N., R.11 E., Huron County, Hydrologic Unit 04080103, at Berne Road, 2.3 mi northeast of Elkton.	73.3	--	04-21-88 07-14-88	*35.2 *0.01
04159037	Bad Axe Creek	Pinnebog River	Lat 43°53'28", long 83°08'28", in NW1/4 NW1/4 sec.24, T.17 N., R.11 E., Huron County, Hydrologic Unit 04080103, at Filion Road, 5.5 mi northeast of Elkton.	28.3	--	04-21-88 07-13-88	*13.0 0.00

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements Date	 Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE HURON--Continued				
04159063	Taft Drain	Pinnebog River	Lat 43°57'52", long 83°05'53", in SE1/4 SW1/4 sec.20, T.18 N., R.12 E., Huron County, Hydrologic Unit 04080103, at Oak Beach Road, 2.0 mi northeast of Pinnebog.	31.1	--	04-19-88 07-14-88	*10.9 *0.43
04159069	New River	Lake Huron	Lat 44°00'05", long 82°52'25", in SW1/4 SE1/4 sec.7, T.18 N., R.14 E., Huron County, Hydrologic Unit 04080104, at Stoddard Road, 2.8 mi southwest of Huron City.	22.1	--	04-20-88 07-14-88	*5.27 0.00
04159075	East Branch Willow Creek	Willow Creek	Lat 43°53'59", long 82°50'22", in SW1/4 SW1/4 sec.16, T.17 N., R.14 E., Huron County, Hydrologic Unit 04080104, at Filion Road, 2.1 mi south of Redman.	32.0	--	04-20-88 07-14-88	9.25 0.00
04159077	Willow Creek	Lake Huron	Lat 43°55'42", long 82°51'13", in NW1/4 NE1/4 sec.8, T.17 N., R.14 E., Huron County, Hydrologic Unit 04080104, at Redman Road, 1.0 mi west of Redman.	69.8	--	04-20-88 07-14-88	25.7 0.00
04159078	Willow Creek	Lake Huron	Lat 44°00'02", long 82°51'15", in NW1/4 NE1/4 sec.17, T.18 N., R.14 E., Huron County, Hydrologic Unit 04080104, at Stoddard Road, 2.3 mi southwest of Huron City.	74.4	--	04-20-88 07-14-88	28.6 *0.01
04159096	Rock Falls Creek	Lake Huron	Lat 43°48'40", long 82°39'45", in NW1/4 SW1/4 sec.24, T.16 N., R.15 E., Huron County, Hydrologic Unit 04080104, at Schuck Road, 2.4 mi southwest of Harbor Beach.	30.4	--	04-20-88 07-14-88	10.4 *0.26
04159104	Elm Creek	Lake Huron	Lat 43°44'24", long 82°38'33", in SE1/4 NE1/4 sec.13, T.15 N., R.15 E., Huron County, Hydrologic Unit 04080104, at Edwards Road, 2.8 mi northwest of White Rock.	24.4	--	04-20-88 07-14-88	6.43 *0.44
04159120	Mill Creek	Lake Huron	Lat 43°14'21", long 82°34'14", in SE1/4 SE1/4 sec.3, T.9 N., R.16 E., Sanilac County, Hydrologic Unit 04080104, at Mortimer Line Road, 3.2 mi northeast of Amadore.	--	--	05-07-88	b0.00
			STREAMS TRIBUTARY TO LAKE ST. CLAIR				
04161000	Clinton River	Lake St. Clair	Lat 42°38'00", long 83°13'28", in NE1/4 NW1/4 sec.36, T.3 N., R.10 E., Oakland County, Hydrologic Unit 04090003, at former gaging station, at Auburn Road, in Auburn Heights.	123	1935-40‡, 1957-82‡, 1983-88f	08-11-88	b26.4
04161010	Clinton River	Lake St. Clair	Lat 42°38'48", long 83°12'46", in NE1/4 NE1/4 sec.25, T.3 N., R.10 E., Oakland County, Hydrologic Unit 04090003, at Hamlin Road, 2.0 mi southwest of Pontiac.	--	--	08-11-88	b25.8
04164460	Deer Creek	North Branch Clinton River	Lat 42°41'27", long 82°52'43", in SW1/4 SW1/4 sec.12, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at North Road, 2.0 mi south of Meade.	--	--	06-30-88	b0.00
04164510	Newland Drain	Middle Branch Clinton River	Lat 42°40'58", long 83°04'38", in SE1/4 SE1/4 sec.7, T.3 N., R.12 E., Macomb County, Hydrologic Unit 04090003, at 24 Mile Road, 3.5 mi southwest of Washington.	--	--	07-05-88	b0.00
04165000	Middle Branch Clinton River	North Branch Clinton River	Lat 42°37'42", long 82°55'52", in NW1/4 NW1/4 sec.4, T.2 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at State Highway 59, 2.0 mi south of Waldenburg.	48.8	1969	06-30-88	*b0.03

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
STREAMS TRIBUTARY TO DETROIT RIVER							
04165992	River Rouge	Detroit River	Lat 42°33'31", long 83°13'00", in NE1/4 NW1/4 sec.25, T.2 N., R.10 E., Oakland County, Hydrologic Unit 04090004, at Redding Street in Birmingham.	--	1986-87	03-08-88	b15.3
						03-16-88	b10.5
						04-15-88	b8.09
						05-24-88	b4.22
						06-17-88	*b2.55
04166350	Upper River Rouge	River Rouge	Lat 42°23'59", long 83°17'11", in NE1/4 NW1/4 sec.20, T.1 S., R.10 E., Wayne County, Hydrologic Unit 04090004, at Fenkel Road in Redford.	22.2	1967-68, 1976-77, 1986-87	03-08-88	b32.4
						05-24-88	b7.26
						06-17-88	*b2.55
04166395	Unnamed tributary	Bell Branch	Lat 42°25'33", long 83°23'33", in SW1/4 SW1/4 sec.4, T.1 S., R.9 E., Wayne County, Hydrologic Unit 04090004, at 7 Mile Road in Livonia.	--	1987	01-28-88	*b1.03
						03-08-86	b2.84
						03-16-88	b1.59
						04-15-88	b0.47
						05-24-88	b0.89
						06-17-88	b0.00
04166450	Bell Branch	Upper River Rouge	Lat 42°23'32", long 83°17'45", in NW1/4 SW1/4 sec.20, T.1 S., R.10 E., Wayne County, Hydrologic Unit 04090004, at Beech Daly Road in Redford.	40.8	1967-68, 1976-77, 1986-87	03-08-88	b34.2
						04-15-88	b13.3
						05-24-88	b10.1
						06-17-88	*b2.17
04166647	Johnson Drain	Middle River Rouge	Lat 42°22'46", long 83°34'41", in SE1/4 SW1/4 sec.23, T.1 S., R.7 E., Washtenaw County, Hydrologic Unit 04090004, at Salem Road, 2.0 mi south of Salem.	--	--	06-28-88	b0.00
04166700	Johnson Drain	Middle River Rouge	Lat 42°25'33", long 83°28'43", in SW1/4 SE1/4 sec.3, T.1 S., R.8 E., Wayne County, Hydrologic Unit 04090004, at 7 Mile Road in Northville.	26.1	1967-68, 1976-77, 1986-87	01-28-88	*b13.0
						03-07-88	b33.2
						04-14-88	b20.1
						05-23-88	b8.06
						06-16-88	*b3.98
04166730	Middle River Rouge	River Rouge	Lat 42°24'02", long 83°28'08", in NW1/4 SW1/4 sec.14, T.1 S., R.8 E., Wayne County, Hydrologic Unit 04090004, at Northville Road, 1.5 mi north of Plymouth.	--	1974, 1986-87	01-28-88	*b33.0
						03-07-88	b68.1
						04-14-88	b46.5
						05-23-88	b19.8
						06-16-88	*b11.6
04166900	Tonquish Creek	Middle River Rouge	Lat 42°21'07", long 83°23'10", in NW1/4 NW1/4 sec.4, T.2 S., R.9 E., Wayne County, Hydrologic Unit 04090004, at Wayne Road, 0.7 mi west of Nankin Mills.	24.2	1967-68, 1976-77, 1986-87	01-28-88	*b8.03
						03-07-88	b18.1
						04-14-88	b16.6
						05-23-88	b11.8
						06-16-88	*b2.70
04167495	Lower River Rouge	River Rouge	Lat 42°16'46", long 83°27'24", in SW1/4 SE1/4 sec.26, T.2 S., R.8 E., Wayne County, Hydrologic Unit 04090004, at Lilley Road, 3.7 mi west of Wayne.	--	1986-87	04-14-88	b13.2
						05-23-88	b3.64
						06-16-88	*b0.12
04167650	Lower River Rouge	River Rouge	Lat 42°16'57", long 83°24'25", in SE1/4 SE1/4 sec.30, T.2 S., R.9 E., Wayne County, Hydrologic Unit 04090004, at Newburg Road in Wayne.	--	1986-87	01-28-88	*b16.4
						03-07-88	b57.6
						04-14-88	b27.1
						05-23-88	b9.82
						06-16-88	*b0.50
STREAMS TRIBUTARY TO LAKE ERIE							
04175343	Polzin Drain	Stony Creek	Lat 42°05'47", long 83°33'17", in NW1/4 NW1/4 sec.36, T.4 S., R.7 E., Washtenaw County, Hydrologic Unit 04100001, at Liss Road, 6.4 mi east of Milan.	--	--	07-21-88	b0.00
04175585	Goose Creek	River Raisin	Lat 42°06'51", long 84°14'56", in NE1/4 NE1/4 sec.24, T.4 S., R.1 E., Jackson County, Hydrologic Unit 04100002, at State Highway 50 in Brooklyn.	39.1	1970, 1984	08-16-88	*b4.73
						09-14-88	*b5.70
04175587	River Raisin	Lake Erie	Lat 42°08'15", long 84°13'15", in NE1/4 SW1/4 sec.8, T.4 S., R.2 E., Jackson County, Hydrologic Unit 04100002, at Wolf Lake Road, 2.0 mi southeast of Napoleon.	--	1979, 1984	06-21-88	*b5.88
						07-13-88	*b5.40
						08-16-88	*b6.91
						09-14-88	*b12.2

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements Date	Measurements Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE ERIE--Continued				
04175592	River Raisin	Lake Erie	Lat 42°09'23", long 84°11'02", in SE1/4 NW1/4 sec.3, T.4 S., R.2 E., Jackson County, Hydrologic Unit 04100002, downstream from dam at Mill Road in Norvell.	--	1985c	07-13-88 08-16-88 09-14-88	bc2.96 bc5.80 bc13.3
04175597	River Raisin	Lake Erie	Lat 42°10'04", long 84°07'21", in NE1/4 SW1/4 sec.31, T.3 S., R.3 E., Washtenaw County, Hydrologic Unit 04100002, at Sharon Valley Road, 2.0 mi southwest of Sharon Hollow.	121	1970-72, 1985	06-21-88 07-13-88	*b7.06 *b4.02
04175610	River Raisin	Lake Erie	Lat 42°08'52", long 84°00'56", in SE1/4 SE1/4 sec.1, T.4 S., R.3 E., Washtenaw County, Hydrologic Unit 04100002, at Austin Road, 0.5 mi east of Manchester.	148	1970-72, 1979, 1984-85	08-16-88	*b16.0
04175615	Unnamed tributary	River Raisin	Lat 42°08'38", long 83°59'37", in SE1/4 NE1/4 sec.7, T.4 S., R.4 E., Washtenaw County, Hydrologic Unit 04100002, at Austin Road, 2.0 mi east of Manchester.	--	--	07-13-88	*b1.21
04175630	River Raisin	Lake Erie	Lat 42°05'36", long 83°58'35", in SW1/4 SE1/4 sec.29, T.4 S., R.4 E., Washtenaw County, Hydrologic Unit 04100002, at Allen Road, 1.5 mi north of Clinton.	167	1970-72, 1984	06-21-88 07-13-88	*b18.5 *b14.3
04175650	Iron Creek	River Raisin	Lat 42°05'37", long 83°59'17", in SW1/4 SW1/4 sec.29, T.4 S., R.4 E., Washtenaw County, Hydrologic Unit 04100002, at Bartlet Road, 1.7 mi north of Clinton.	28.8	1970-72	06-21-88	*b3.36
04175700	River Raisin	Lake Erie	Lat 41°56'35", long 83°56'45", in SE1/4 NE1/4 sec.21, T.6 S., R.4 E., Lenawee County, Hydrologic Unit 04100002, at former gaging station, at North Raisin Center Highway, 4.5 mi south of Tecumseh.	267	1956-80†, 1983-84	06-21-88 07-13-88	*b39.0 *b30.4
04175740	South Branch River Raisin	River Raisin	Lat 41°51'20", long 84°10'44", in NE1/4 NE1/4 sec.21, T.7 S., R.2 E., Lenawee County, Hydrologic Unit 04100002, at Seneca Highway, 3.0 mi east of Clayton.	--	--	08-16-88	b0.00
04175840	South Branch River Raisin	River Raisin	Lat 41°51'35", long 84°03'09", in NE1/4 NW1/4 sec.22, T.7 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at Carleton Road, 2.0 mi south of Adrian.	--	--	07-13-88	*b2.84
04175905	Wolf Creek	South Branch River Raisin	Lat 41°59'13", long 84°08'39", in SE1/4 SW1/4 sec.36, T.5 S., R.2 E., Lenawee County, Hydrologic Unit 04100002, at Teachout Road, 2.0 mi southwest of Onstead.	--	--	08-16-88	*b1.25
04175947	Wolf Creek	South Branch River Raisin	Lat 41°54'46", long 84°04'45", in SE1/4 SW1/4 sec.28, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at Wolf Creek Highway, 1.5 mi west of Adrian.	--	--	07-13-88	*b1.75
04175950	Wolf Creek	South Branch River Raisin	Lat 41°55'02", long 84°03'53", in NW1/4 SW1/4 sec.27, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at Tipton Road, 2.0 mi northwest of Adrian.	69.7	1955, 1963-64, 1970, 1977	10-28-86 11-20-86 01-07-87 02-20-87 04-02-87 05-13-87 06-23-87 08-06-87 08-20-87 09-17-87 10-29-87 12-10-87 04-05-88	36.2 21.4 *32.3 *27.7 93.0 17.0 26.5 *4.71 *2.50 25.0 41.6 228 503

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

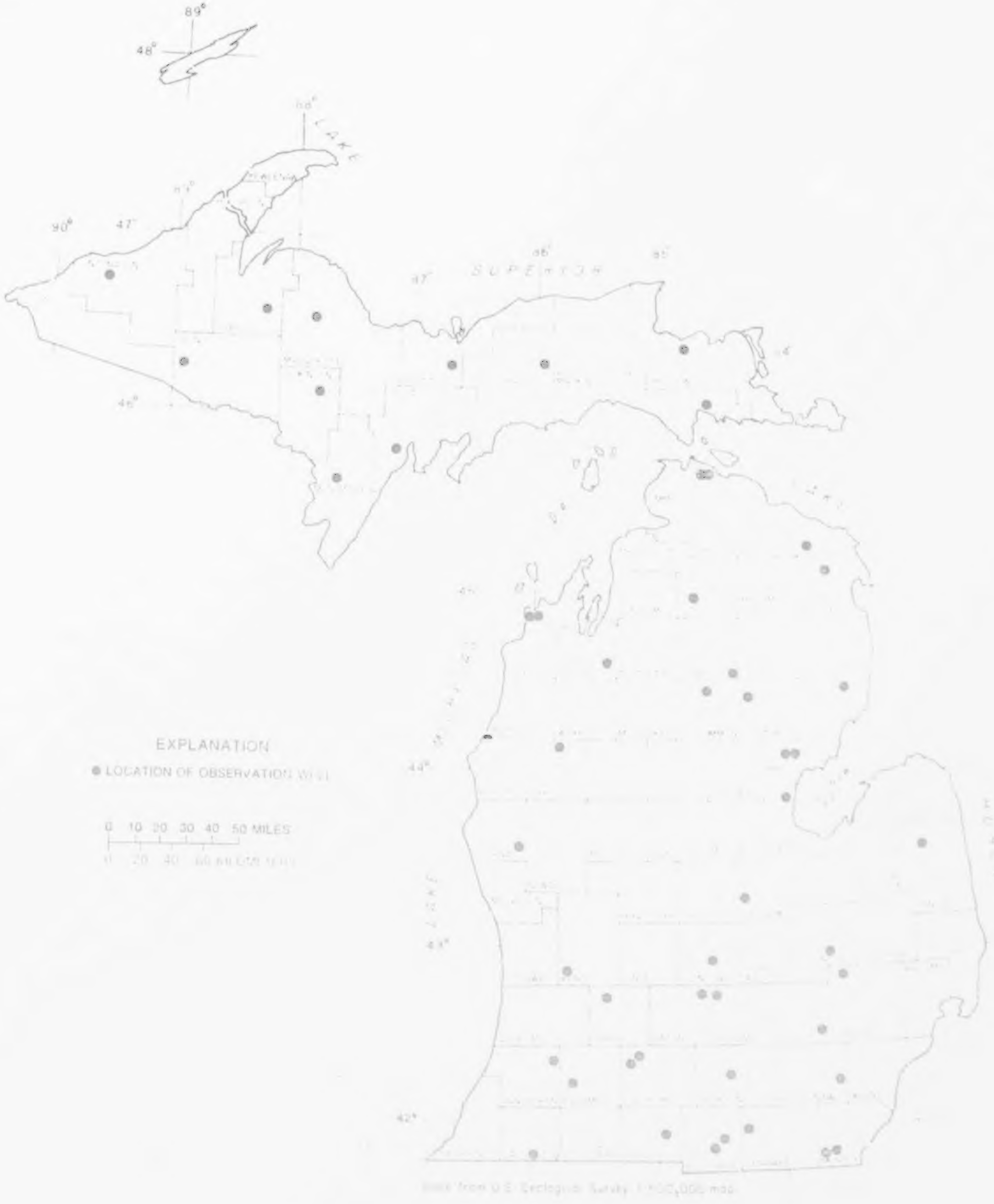
Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements Date	Measurements Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE ERIE--Continued				
04175957	South Branch River Raisin	River Raisin	Lat 41°54'35", long 84°01'49", in NE1/4 NE1/4 sec.35, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at State Highway 52 in Adrian.	--	--	07-13-88	*b3.38
04175960	South Branch River Raisin	River Raisin	Lat 41°55'03", long 84°00'37", in SE1/4 sec.25, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at Howell Highway, 2.0 mi northeast of Adrian.	165	1970-72, 1977, 1979-88f	06-21-88	*b12.9
04176020	Bear Creek	Black Creek	Lat 41°47'53", long 84°10'38", in SE1/4 SE1/4 sec.4, T.8 S., R.2 E., Lenawee County, Hydrologic Unit 04100002, at Seneca Highway, 1.0 mi north of Seneca.	17.1	1970	08-16-88	*b0.58
04176075	Black Creek	River Raisin	Lat 41°48'19", long 83°57'56", in NE1/4 SE1/4 sec.5, T.8 S., R.4 E., Lenawee County, Hydrologic Unit 04100002, at Bruce Highway, 0.8 mi southeast of Ogden.	--	--	07-13-88	*b0.17
04176103	Bear Creek	Black Creek	Lat 41°48'02", long 83°57'32", in NW1/4 NW1/4 sec.9, T.6 S., R.4 E., Lenawee County, Hyrologic Unit 04100002, at Victoryville Road, 5.0 mi southwest of Blissfield.	--	1963-64	07-13-88	b0.00
04176140	River Raisin	Lake Erie	Lat 41°50'03", long 83°52'00", in SE1/4 SE1/4 sec.30, T.7 S., R.5 E., Lenawee County, Hydrologic Unit 04100002, at U.S. Highway 223 in Blissfield.	643	1970, 1982, 1984	06-21-88	*b60.3
04176165	Dunlop Drain	River Raisin	Lat 41°55'36", long 83°42'38", in SW1/4 SW1/4 sec.27, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Petersburg Road, 3.1 mi southwest of Dundee.	--	--	07-13-88	b0.00
04176167	Little River Raisin	River Raisin	Lat 41°56'32", long 83°42'41", in NW1/4 SW1/4 sec.22, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Petersburg Road, 2.5 mi west of Dundee.	--	--	07-13-88	b0.00
04176168	Swamp Raisin Creek	Little River Raisin	Lat 41°55'18", long 83°49'15", in SE1/4 SW1/4 sec.27, T.6 S., R.5 E., Lenawee County, Hydrologic Unit 04100002, at Laberdee Road, 3.5 mi northwest of Deerfield.	--	--	07-13-88	b0.00
04176171	Swamp Raisin Creek	Little River Raisin	Lat 41°56'50", long 83°42'47", in SW1/4 NW1/4 sec.22, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Petersburg Road, 2.5 mi west of Dundee.	--	--	07-13-88	b0.00
04176200	River Raisin	Lake Erie	Lat 41°57'23", long 83°39'32", in SW1/4 SE1/4 sec.13, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at State Highway 50 in Dundee.	761	1970, 1984	06-21-88 07-13-88 08-16-88 09-14-88	b51.4 *b11.9 b63.9 b68.6
04176220	Middle Branch Macon Creek	South Branch Macon Creek	Lat 41°58'51", long 83°47'16", in NW1/4 NW1/4 sec.11, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Wilcox Road, 2.0 mi northwest of Dundee.	43.8	1970	06-21-88 07-13-88	*b0.19 b0.00
04176240	South Branch Macon Creek	Macon Creek	Lat 41°57'42", long 83°49'48", in NW1/4 NW1/4 sec.15, T.6 S., R.5 E., Lenawee County, Hydrologic Unit 04100002, at Britton Highway, 1.7 mi south of Britton.	10.9	1970	08-16-88	*b0.40
04176241	Schroeder Drain	South Branch Macon Creek	Lat 41°57'56", long 83°48'40", in NE1/4 NE1/4 sec.15, T.6 S., R.5 E., Lenawee County, Hydrologic Unit 04100002, at Pucklington Road, 2.0 mi southeast of Britton.	--	--	07-13-88 08-16-88	b0.00 *b0.02

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1988--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi²)	Measured previously (water years)	Measurements	
						Date	Discharge (ft³/s)
			STREAMS TRIBUTARY TO LAKE ERIE--Continued				
04176245	Dibble Drain	South Branch Macon Creek	Lat 41°57'13", long 83°48'38", in SE1/4 SE1/4 sec.15, T.6 S., R.5 E., Lenawee County, Hydrologic Unit 04100002, at Hoagland Highway, 2.5 mi southeast of Britton.	--	--	07-13-88	[b]0.00
04176260	South Branch Macon Creek	Macon Creek	Lat 41°58'38", long 83°41'16", in SW1/4 NW1/4 sec.11, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Wilcox Road, 2.0 mi northwest of Dundee.	45.5	1970	06-21-88	°[b]0.41
04176310	North Branch Macon Creek	Macon Creek	Lat 42°01'0 ", long 83°40'02", in SE1/4 NW1/4 sec.25, T.5 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Ostrander Road in Azalia.	23.0	1970	06-21-88	[b]0.00
04176320	North Branch Macon Creek	Macon Creek	Lat 41°59'56", long 83°39'40", in SW1/4 SE1/4 sec.36, T.5 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Day Road, 2.0 mi north of Dundee.	45.1	1970	06-21-88	[b]0.00
04176365	Saline River	River Raisin	Lat 42°10'15", long 83°49'32", in SE1/4 SW1/4 sec.34, T.3 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at Dell Road, 2.0 mi west of Saline.	44.3	1964, 1980-82	08-16-88	°[b]5.38
04176400	Saline River	River Raisin	Lat 42°07'50", long 83°46'35", in SW1/4 sec.18, T.4 S., R.6 E., Washtenaw County, Hydrologic Unit 04100002, at former gaging station, at Maple Road, 2.8 mi south of Saline.	94.6	1966-77†, 1978-88[f]	06-21-88 07-13-88	°[b]14.0 °[b]11.2

° Base flow.
† Operated as a continuous-record gaging station.
[a] Approximately.
[b] Discharge measurement made by employees of Michigan Department of Natural Resources.
[c] Affected by regulation and diversion.
[d] Previously published as station number 04057605.
[e] Operated as a low-flow partial-recrod station.
[f] Operated as a crest-stage partial-record station.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● LOCATION OF OBSERVATION WELL
0 10 20 30 40 50 MILES
0 20 40 60 80 KILOMETERS

Base from U.S. Geological Survey 1:500,000 map

Figure 16.--Location of observation wells published in this report.

ALGER COUNTY

461608086373801. Local number, 45N 19W 25BDCD.
LOCATION.--Lat 46°16'08", long 86°37'38", Hydrologic Unit 04060106, 250 ft northwest of State Highway 44, and 0.2 mi northeast of Kentucky. Owner: U.S. Forest Service.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 66 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.6 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--June 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 6.35 ft below land-surface datum June 29, 1960; lowest measured, 14.19 ft below land-surface datum, Apr. 3, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 3	12.73	MAR 9	12.02	JUN 9	12.46	SEP 2	12.86

ALPENA COUNTY

450850083393401. Local number, 32N 6E 23DDDA.
LOCATION.--Lat 45°08'50", long 83°39'34", Hydrologic Unit 04070006, on Graham Road, 3 mi east and 1.5 mi north of Long Rapids. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water table observation well, diameter 6 in., depth 88 ft, screened 79 to 88 ft.
INSTRUMENTATION.--Water level recorder.
DATUM.--Elevation of land-surface datum is 713 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.7 ft above land surface datum.
REMARKS.--Bottom of hole near top of bedrock.
PERIOD OF RECORD.--November 1976 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 13.61 ft below land surface datum, May 22, 1983; lowest recorded, 30.01 ft below land surface datum, Mar. 27, 1982.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	23.33	24.04	24.32	22.53	22.34	23.86	19.53	18.02	19.12	21.26	23.38	24.28
10	23.65	24.08	24.15	22.46	22.74	23.78	18.28	18.52	19.40	21.73	23.46	24.58
15	23.73	24.17	23.90	22.49	22.95	23.53	17.63	18.44	10.61	22.24	23.41	24.80
20	23.89	24.28	23.52	22.41	23.23	23.73	17.12	18.70	19.86	22.58	23.57	24.91
25	24.03	24.41	23.22	22.61	23.47	23.55	17.63	18.87	20.16	22.83	[illegible]	25.02
EOM	24.09	24.19	22.67	22.74	23.69	21.73	17.75	19.13	20.69	23.14	24.26	25.11

WTR YR 1988 HIGHEST 16.92 APR 20, 1988 LOWEST 25.11 SEP 30, 1988

ARENAC COUNTY

440342083542801. Local number, 19N 5E 7DABA1.
LOCATION.--Lat 44°03'42", long 83°54'28", Hydrologic Unit 04080101, 3 mi northeast of Omer. Owner: U.S. Geological Survey.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 185 ft., screened 180 to 185 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 667 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.60 ft above land-surface datum.
PERIOD OF RECORD.--June 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.28 ft below land-surface datum, July 15, 1980; lowest measured, 11.85 ft below land-surface datum, Aug. 31, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 16	11.39	JAN 14	10.72	APR 4	10.22	JUN 13	10.60	JUL 27	11.33	AUG 31	11.85
DEC 1	10.64	FEB 22	10.07	MAY 10	10.04						

ARENAC COUNTY--Continued

440342083542801. Local number, 19N 5E 7DABA2.
LOCATION.--Lat 44°03'42", long 83°54'28", Hydrologic Unit 04080101, 3 mi northeast of Omer.
Owner: U.S. Geological Survey.
AQUIFER.--Lake bed sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 21 ft, screened 16 to 21 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 667 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.20 ft above land-surface datum.
PERIOD OF RECORD.--June 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 2.35 ft below land-surface datum, Apr. 29, 1985; lowest measured, 7.05 ft below land-surface datum, Oct. 16, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 16	7.05	JAN 14	5.64	APR 4	4.27	JUN 13	4.90	JUL 27	6.03	AUG 31	6.48
DEC 1	6.30	FEB 22	5.45	MAY 10	3.97						

BARAGA COUNTY

463353088144301. Local number, 48N 33W 13DDCC.
LOCATION.--Lat 46°33'53", long 88°14'43", Hydrologic Unit 04030107, 95 ft north of U.S. Highway 41, and 0.5 mi southeast of Nestoria Road. Owner: Michigan Department of State Highways.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.5 in., depth 10 ft, screened 7 to 10 ft.
INSTRUMENTATION.--Monthly measurement by observer.
DATUM.--Elevation of land-surface datum is 1,630 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.78 ft above land-surface datum.
PERIOD OF RECORD.--September 1948 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.27 ft below land-surface datum, Apr. 30, 1965; lowest measured, 9.93 ft below land-surface datum, Jan. 30, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 30	7.02	JAN 14	7.32	MAR 31	7.12	MAY 31	7.51	JUL 31	8.06	SEP 27	7.46
NOV 30	6.83	31	7.10	APR 30	6.97	JUN 30	7.92	AUG 31	8.56	30	7.95
DEC 30	7.22	FEB 29	7.08	MAY 26	7.49						

BARRY COUNTY

424540085232001. Local number, 4N 10W 5DAAA.
LOCATION.--Lat 42°45'40", long 85°23'20", Hydrologic Unit 04050007, on [illegible] Road, 4 mi east and 3.5 mi north of Middleville. Owner: Michigan Department of Natural Resources.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 2 in., depth 131 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 880 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--December 1964 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 111.52 ft below land-surface datum, Mar. [illegible], 1978; lowest measured, 122.02 ft below land-surface datum, Mar. 5, 1965.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 7	115.82	NOV 20	116.01	JAN 7	116.13	MAY 11	115.61	AUG 4	115.65

BAY COUNTY

435128083582401. Local number, 17N 4E 22DCAA.
LOCATION.--Lat 43°51'28", long 83°58'24", Hydrologic Unit 04080102, at end of Second Street in Pinconning. Owner: Pinconning Township.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 110 ft, cased to 60 ft, open bottom.
INSTRUMENTATION.--Monthly measurement. Water level recorder from August 1962 to October 1979.
DATUM.--Elevation of land surface datum is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood shelter base, 2.00 ft above land-surface datum.
REMARKS.--Water levels affected by regional pumping.
PERIOD OF RECORD.--August 1962 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 0.05 ft below land-surface datum, Mar. 5, 1976; lowest recorded, 10.53 ft below land surface datum, Aug. 8, 1963.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 16	3.87	JAN 11	2.20	APR 4	2.12	JUN 11	5.09	JUL 27	6.51	AUG 31	5.73
DEC 1	2.66	FEB 22	2.50	MAY 10	2.14						

BRANCH COUNTY

415602084593701. Local number, 6S 6W 32CABA.
LOCATION.--Lat 41°56'02", long 84°59'37", Hydrologic Unit 04050001, at Bennett and Tibbits Streets in Coldwater. Owner: City of Coldwater.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 113 ft, screened 108 to 113 ft.
INSTRUMENTATION.--Water level recorder.
DATUM.--Elevation of land-surface datum is 970 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood shelter base, 2.50 ft above land-surface datum.
REMARKS.--Water levels affected by nearby pumping.
PERIOD OF RECORD.--January 1964 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 9.0 ft below land surface datum, May 6, 1975; lowest recorded, 25.9 ft below land surface datum, May 25, 1977.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	18.86	23.56	14.56	13.36	22.46	---	12.67	15.48	13.10	24.25	19.00	14.94
10	15.08	23.54	17.54	20.56	23.10	---	11.26	17.44	20.50	15.39	24.05	15.03
15	24.13	14.97	23.19	21.38	21.79	---	11.82	12.54	20.63	17.92	24.55	19.73
20	24.17	23.69	16.34	22.52	---	---	16.21	14.39	17.37	23.92	14.96	22.97
25	18.98	23.81	12.59	21.72	---	---	20.04	13.03	17.35	17.50	24.44	23.00
EOM	17.74	23.65	15.55	15.83	---	---	12.43	20.50	17.42	14.68	18.20	18.31

WTR YR 1988 HIGHEST 10.64 APR 10, 1988 LOWEST 24.97 AUG 12, 1988

CALHOUN COUNTY

422422085071501. Local number, 1S 7W 10BBAB.
LOCATION.--Lat 42°24'22", long 85°07'15", Hydrologic Unit 04050003, at State Highways 78 and 66, 5 mi north of Battle Creek. Owner: Rilla Sabin.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Dug water-table well, diameter 1.25 in., depth 12 ft, screened 9 to 12 feet.
INSTRUMENTATION.--Weekly measurement by observer.
DATUM.--Elevation of land-surface datum is 970.99 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 1.50 ft above land-surface datum.
PERIOD OF RECORD.--September 1946 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 0.89 ft below land surface datum, Mar. 28, 1950; lowest, dry, July 29, 1964.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 7	4.99	DEC 2	5.10	FEB 3	4.00	APR 6	3.36	JUN 1	3.36	AUG 3	4.48
14	5.04	9	5.02	10	3.92	13	3.29	8	3.44	10	4.46
21	5.10	16	4.97	17	3.86	20	3.23	15	3.61	17	4.50
28	5.12	23	4.90	24	3.74	27	3.17	22	3.86	24	4.62
NOV 4	5.17	30	4.52	MAR 2	3.70	MAY 4	3.20	29	4.20	31	4.83
12	5.17	JAN 6	4.41	9	3.66	11	3.23	JUL 5	4.30	SEP 7	4.80
18	5.16	13	4.31	16	3.60	18	3.24	12	4.36	14	4.77
25	5.16	20	4.22	23	3.50	25	3.26	19	4.50	21	4.68
		27	4.10	30	3.40			27	4.52	28	4.49

CALHOUN COUNTY--Continued

422025085084001. Local number, 1S 7W 32DABA.

LOCATION.--Lat 42°20'25", long 85°08'40", Hydrologic Unit 04050003, at Verona well field in Battle Creek. Owner: City of Battle Creek.

AQUIFER.--Marshall Formation of Mississippian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 127 ft, cased to 103 ft.

INSTRUMENTATION.--Daily measurement by observer.

DATUM.--Elevation of land-surface datum is 830.79 ft above National Geodetic Vertical Datum of 1929. Measuring point: Recorder base, 2.10 ft above land-surface datum.

REMARKS.--Water levels affected by nearby municipal pumping.

PERIOD OF RECORD.--October 1939 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 0.7 ft below land-surface datum, Apr. 26, 27, 1950; lowest measured, 16.75 ft below land-surface datum, July 16, 1959.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	11.10	11.60	11.50	10.30	10.00	9.00	9.80	9.35	9.70	11.00	13.20	10.60
10	11.50	11.70	11.30	10.60	10.10	10.00	9.50	9.90	11.40	11.10	12.20	10.90
15	11.30	10.90	11.20	10.60	9.60	9.80	9.80	9.00	12.15	12.50	12.60	10.40
20	11.30	11.70	10.70	10.50	10.00	9.50	10.00	9.00	11.40	11.90	11.90	10.80
25	11.70	11.20	9.80	10.40	9.90	10.30	9.90	9.50	10.40	11.70	12.20	9.90
EOM	11.90	11.20	10.10	10.20	9.70	9.70	8.90	10.70	11.60	11.60	11.00	10.40

CASS COUNTY

414651085575601. Local number, 8S 14W 17BAAA.

LOCATION.--Lat 41°46'51", long 85°57'56", Hydrologic Unit 04050001, at U.S. Highway 112, 2 mi east of Adamsville. Owner: Ted Little.

AQUIFER.--Glacial deposits of Pleistocene age.

WELL CHARACTERISTICS.--Dug water-table well, diameter 28 in., depth 55 ft, cribbed with brick to open bottom.

INSTRUMENTATION.--Monthly measurement by observer.

DATUM.--Elevation of land-surface datum is 840 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of wooden platform, 0.80 ft above land-surface datum.

PERIOD OF RECORD.--September 1945 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 46.20 ft below land-surface datum, July 16, 1950; lowest measured, dry, Mar. 10, 1947, Jan. 23, Feb. 24, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 25	51.30	DEC 22	51.70	FEB 24	dry	MAY 23	52.80	JUL 25	52.85	SEP 26	52.75
NOV 25	51.55	JAN 23	dry	APR 25	53.10	JUN 23	52.80	AUG 23	53.00		

CHEBOYGAN COUNTY

454427084424001. Local number, 39N 3W 29CBCB1.

LOCATION.--Lat 45°44'27", long 84°42'40", Hydrologic Unit 04070003, at Stimpson Road, 3 mi southeast of Mackinaw City. Owner: U.S. Geological Survey.

AQUIFER.--Dundee Formation of Devonian age.

WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 121 ft, cased to 101 ft, open bottom.

INSTRUMENTATION.--Monthly measurement.

DATUM.--Elevation of land-surface datum is 705 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.

PERIOD OF RECORD.--January 1979 to current year.

EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 4.71 ft below land-surface datum, Apr. 8, 1986; lowest measured, 11.68 ft below land-surface datum, Feb. 11, 1981.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 2	10.60	DEC 17	7.91	MAR 9	7.70	MAY 26	6.32	JUL 6	9.02	AUG 18	9.51
NOV 10	9.21	JAN 27	7.92	APR 13	5.03						

CHEBOYGAN COUNTY--Continued

454427084424002. Local number, 39N 3W 29CBCB2.
LOCATION.--Lat 45°44'27", long 84°42'40", Hydrologic Unit 04070003, at Stimpson Road, 3 mi southeast of Mackinaw City. Owner: U.S. Geological Survey.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water table well, diameter 6 in., depth 55 ft, screened 40 to 55 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 705 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.5 ft above land-surface datum.
PERIOD OF RECORD.--February 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 1.80 ft below land-surface datum, Apr. 8, 1986; lowest measured, 6.47 ft below land-surface datum, Feb. 11, 1982.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 2	5.90	DEC 17	4.05	MAR 9	3.89	MAY 26	2.76	JUL 6	4.90	AUG 18	4.78
NOV 10	4.72	JAN 27	4.23	APR 13	2.09						

CHIPPEWA COUNTY

462159084442201. Local number, 46N 4W 24DADA.
LOCATION.--Lat 46°21'59", long 84°44'22", Hydrologic Unit 04020201, on trail 0.2 mi south of State Highway 28, 1 mi west of Raco. Owner: U.S. Forest Service.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 54 ft.
INSTRUMENTATION.--Water level recorder.
DATUM.--Elevation of land surface datum is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 3.07 ft above land-surface datum.
PERIOD OF RECORD.--June 1952 to April 1965. November 1969 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 18.40 ft below land surface datum, June 7, 1971; lowest recorded, 28.43 ft below land surface datum, Apr. 14, 1964.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	26.90	27.12	27.28	26.84	26.93	27.32	27.66	25.33	24.78	25.27	25.80	26.32
10	26.96	27.14	27.25	26.80	27.00	27.38	27.54	25.10	24.84	25.36	25.89	26.40
15	27.00	27.16	27.21	26.77	27.06	27.43	27.00	24.94	24.90	25.47	25.97	26.48
20	27.05	27.18	27.12	26.78	27.14	27.48	26.46	24.86	24.97	25.55	26.05	26.57
25	27.08	27.21	27.01	26.81	27.22	27.52	25.98	24.80	25.08	25.63	26.13	26.65
EOM	27.11	27.24	26.89	26.88	27.28	27.59	25.61	24.76	25.17	25.72	26.21	26.72

WTR YR 1988 HIGHEST 24.76 MAY 29,30,31, JUNE 1, 1988 LOWEST 27.66 APR 5, 1988

CLINTON COUNTY

425410084323501. Local number, 6N 2W 16DDAD.
LOCATION.--Lat 42°54'10", long 84°32'35", Hydrologic Unit 04050005, at U.S. Highway 27, 6 mi south of St. Johns. Owner: Michigan Department of State Highways.
AQUIFER.--Gravel of Pleistocene age.
WELL CHARACTERISTICS.--Driven water table well, diameter 2 in., depth 26 ft, screened 23 to 26 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land surface datum is 803.32 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 0.10 ft below land-surface datum.
REMARKS.--Federal Key well. Measuring point changed from 1.30 ft above land surface datum to 0.10 ft below land surface datum on Sept. 23, 1980.
PERIOD OF RECORD.--August 1942 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 11.64 ft below land surface datum, Apr. 30, 1974; lowest measured, 19.93 ft below land surface datum, Feb. 25, 1964.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	17.41	DEC 23	16.71	FEB 25	16.10	APR 26	15.47	JUN 27	17.41	AUG 26	17.98
NOV 26	17.27	JAN 25	16.07	MAR 25	15.93	MAY 27	16.39	JUL 27	17.83	SEP 18	[illegible]

CRAWFORD COUNTY

443308084245001. Local number, 25N 1W 15DDCD.
LOCATION.--Lat 44°33'08", long 84°24'50", Hydrologic Unit 04070007, at State Highway 18, 2.6 mi south of Eldorado. Owner: U.S. Forest Service.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 56 ft, cased.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 1,190 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 2.95 ft above land-surface datum.
PERIOD OF RECORD.--November 1948 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 25.55 ft below land-surface datum, Nov. 10, 1986; lowest recorded, 35.97 ft below land-surface datum Apr. 4-6, 1951.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	28.26	28.42	28.62	28.78	28.83	28.66	28.49	27.83	27.50	27.71	28.02	28.34
10	28.31	28.50	28.62	28.79	28.82	28.61	28.44	27.69	27.50	27.75	28.07	28.40
15	28.32	28.51	28.66	28.79	28.72	28.60	28.33	27.64	27.52	27.79	28.12	28.46
20	28.33	28.53	28.68	28.78	28.69	28.61	28.21	27.58	27.55	27.85	28.17	28.50
25	28.39	28.57	28.74	28.79	28.68	28.61	28.09	27.54	27.58	27.91	28.22	28.55
EOM	28.43	28.55	28.76	28.80	28.57	28.58	27.95	27.51	27.64	27.97	28.29	28.61

WTR YR 1988 HIGHEST 27.48 JUN 7,8,9, 1988 LOWEST 28.83 FEB 4,5, 1988

DELTA COUNTY

454446087090401. Local number, 39N 23W 28ADCC.
LOCATION.--Lat 45°44'46", long 87°09'04", Hydrologic Unit 04030111, 3.5 mi west of Escanaba. Owner: M. Blake.
AQUIFER.--Munising Sandstone of Cambrian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 5 in., depth 530 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 680 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 3.10 ft above land-surface datum.
PERIOD OF RECORD.--July 1968 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 1.9 ft below land-surface datum, May [illegible], 1960; lowest recorded, 8.9 ft below land-surface datum, Feb. 5, 1977.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	6.46	6.04	5.91	5.93	5.92	6.28	5.34	5.71	7.04	7.81	7.32	7.52
10	6.47	6.38	5.58	6.09	6.17	5.94	5.36	5.19	7.26	6.76	8.01	7.70
15	6.79	6.03	5.60	6.07	6.22	6.18	5.31	6.18	7.87	6.95	7.87	7.61
20	6.26	5.93	5.64	5.80	6.01	6.09	5.47	6.28	8.12	7.93	7.44	7.42
25	6.13	6.01	5.87	6.06	6.10	5.81	5.62	6.95	8.44	7.51	7.26	7.63
EOM	6.21	5.82	5.77	6.00	6.21	5.71	5.35	6.46	6.84	7.55	7.40	7.63

WTR YR 1988 HIGHEST 5.01 APR 6, 1988 LOWEST 8.71 JULY 1, 1988

DICKINSON COUNTY

460458087493901. Local number, 43N 29W 1ACAB.
LOCATION.--Lat 46°04'58", long 87°49'39", Hydrologic Unit 04030109, 6.25 mi north of Felch. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Augered water-table well, diameter 1.25 in., depth 31 ft, screened 28 to 31 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,160 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Hole in top of cap, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--October 1966 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 12.95 ft below land-surface datum, Apr. 9, 1986; lowest measured, 16.50 ft below land-surface datum, Mar. 2, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 26	15.19	DEC 30	15.12	MAR 3	15.70	APR 27	14.10	JUN 23	15.39	AUG 30	15.62
DEC 1	15.01	JAN 28	15.21	MAR 28	14.82	MAY 24	14.76	JUL 27	15.85	SEP 28	15.61

EATON COUNTY

424435084365001. Local number, 4N 3W 12CDAD.
LOCATION.--Lat 42°44'35", long 84°36'50", Hydrologic Unit 04050004, at Robins Road, in Delta Township, 0.5 mi west of Lansing. Owner: F. Wheeler.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 381 ft, cased to 140 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 862.91 ft above National Geodetic Vertical Datum of 1929. Measuring point: Plywood instrument shelf, 1.00 ft above land-surface datum.
REMARKS.--Water levels affected by pumping.
PERIOD OF RECORD.--October 1953 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 66.70 ft below land-surface datum, Jan. 27, 1988; lowest recorded, 103.6 ft below land-surface datum, Aug. 28, 1969.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	81.13	78.28	69.83	69.68	73.63	78.33	77.70	79.32	84.50	85.46	82.18	73.94
10	82.37	78.26	68.55	70.35	76.39	78.36	78.31	79.80	86.32	85.59	79.03	75.21
15	81.55	77.91	67.55	69.18	75.76	78.48	78.34	80.78	89.69	82.80	78.85	78.22
20	81.04	75.65	70.93	68.86	76.60	78.46	78.23	81.47	86.13	77.14	76.99	75.12
25	79.38	73.09	70.02	67.09	77.14	78.45	77.56	80.13	85.65	76.27	75.06	73.35
EOM	79.00	71.69	70.97	67.26	77.44	76.24	78.50	86.18	84.55	73.32	74.67	73.76

WTR YR 1988 HIGHEST 66.70 JAN 27, 1988 LOWEST 89.69 JUN 15, 1988

GENESEE COUNTY

425552083382801. Local number, 6N 7E 9DCCC.
LOCATION.--Lat 42°55'52", long 83°38'28", Hydrologic Unit 04080204, at Fisher Body Plant in Grand Blanc. Owner: General Motors Corporation.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 10 in., depth 385 ft, cased to 150 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 837.0 ft above National Geodetic Vertical Datum of 1929. Measuring point: Instrument shelf, 1.50 ft above land-surface datum.
REMARKS.--Water levels affected by nearby pumping. Measurements made by Plant Water Department.
PERIOD OF RECORD.--January 1974 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 52.3 ft below land-surface datum, Dec. 29, 1975; lowest recorded, 87.74 ft below land-surface datum, July 9, 1988.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	---	61.18	---	62.17	58.77	62.20	61.25	61.96	76.45	86.85	76.64	72.56
10	---	62.71	---	---	60.79	65.27	58.39	62.23	74.67	---	76.75	69.73
15	64.20	63.21	62.00	---	60.00	65.05	60.35	64.44	78.95	---	72.33	71.12
20	65.06	63.45	62.79	---	60.55	66.20	62.37	69.24	84.46	82.56	73.09	69.65
25	63.64	63.91	61.75	---	61.82	61.13	61.97	---	85.92	77.69	71.85	68.06
EOM	63.45	62.08	62.06	58.64	61.55	64.03	64.47		84.93	76.76	76.15	67.81

WTR YR 1988 HIGHEST 57.56 APR 12, 1988 LOWEST 87.74 JUL 9, 1988

GRAND TRAVERSE COUNTY

443921085213501. Local number, 26N 9W 14ABAA.
LOCATION.--Lat 44°39'21", long 85°21'35", Hydrologic Unit 04060105, 5.5 mi north of Fife Lake. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water table well, diameter 6 in., depth 80 ft, PVC pipe and screen.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 960 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.85 ft above land-surface datum.
PERIOD OF RECORD.--June 1976 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 21.32 ft below land-surface datum, Oct. 22, 26, 27, 1986; lowest recorded, 28.05 ft below land-surface datum, Apr. 3, 1982.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	23.87	24.33	24.71	24.46	---	24.58	24.56	---	23.84	24.16	24.48	24.87
10	23.99	24.40	24.72	24.42	---	24.57	24.45	---	23.90	24.19	24.55	24.93
15	24.04	24.46	24.69	24.39	---	24.59	24.25	---	23.94	24.25	24.61	24.99
20	24.10	24.52	24.63	24.37	---	24.62	24.04	---	23.98	24.31	24.67	25.05
25	24.18	24.60	24.60	---	---	24.59	23.88	23.76	24.06	24.36	24.72	25.11
EOM	24.27	24.64	24.50	---	---	24.63	---	23.80	24.10	24.43	24.81	25.16

WTR YR 1988 HIGHEST 23.72 MAY 24, 1988 LOWEST 25.16 SEP 30, 1988

HILLSDALE COUNTY

415154084315401. Local number, 7S 2W 15BCBA1.
LOCATION.--Lat 41°51'54", long 84°31'54", Hydrologic Unit 04100003, on Trail Road, 7 mi southeast of Hillsdale. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 150 ft, screened 135 to 150 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land surface datum is 1,092 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--November 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 46.14 ft below land-surface datum, Apr. 13, 1982; lowest recorded, 49.37 ft below land-surface datum, Sept. 30, 1988.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 20	48.92	JAN 12	48.78	APR 5	48.41	JUN 27	48.74	AUG 31	49.22	SEP 30	49.37
DEC 1	48.79	FEB 18	48.79	MAY 17	48.23	JUL 29	49.05				

415236084313701. Local number, 7S 2W 10BDDD.
LOCATION.--Lat 41°52'36", long 84°31'37", Hydrologic Unit 04100003, at State Highway 34, 2.5 mi west of Pittsford. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Augered water-table well, diameter 1.25 in., depth 20 ft, screened 17 to 20 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land surface datum is 1,070 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.00 ft above land surface datum.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 5.79 ft below land surface datum, Apr. 13, 1982; lowest measured, 11.1 ft below land surface datum, Sept. 21, 1967.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 20	8.88	JAN 12	7.99	APR 5	7.69	JUN 27	8.65	AUG 8	9.10	SEP 20	8.84
DEC 1	8.49	FEB 18	8.20	MAY 17	8.06						

INGHAM COUNTY

424424084340301. Local number, 4N 2W 17ABAA.
LOCATION.--Lat 42°44'24", long 84°34'03", Hydrologic Unit 04050004, at Kirby and Logan Streets in Lansing. Owner: City of Lansing.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 20 in., depth 424 ft.
INSTRUMENTATION.--Water level recorder. Monthly measurement prior to August 1960.
DATUM.--Elevation of land surface datum is 858.72 ft above National Geodetic Vertical Datum of 1929. Measuring point: Plywood shelter base, 0.5 ft above land surface datum.
REMARKS.--Water levels affected by regional pumping.
PERIOD OF RECORD.--December 1929 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 34.3 ft below land surface datum, December 1929; lowest recorded, 168.3 ft below land surface datum, May 7, 1968.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	74.86	74.48	73.73	72.13	71.41	70.57	69.89	69.85	70.81	74.43	75.82	75.65
10	75.36	74.79	73.23	71.90	71.37	70.09	70.29	69.87	71.71	74.99	75.85	75.59
15	74.98	74.73	---	72.26	70.38	70.13	70.10	69.69	72.37	75.64	75.67	75.54
20	74.64	74.41	---	71.05	70.14	70.32	69.73	69.70	72.30	75.64	75.50	74.87
25	74.95	74.46	---	71.25	---	69.70	69.92	70.21	73.36	75.54	75.45	74.74
EOM	74.87	73.41	72.18	71.29		70.63	69.98	70.43	73.81	75.63	76.01	74.56

WTR YR 1988 HIGHEST 69.16 MAY 9, 1988 LOWEST 76.11 SEP 1, 1988

IOSCO COUNTY

442839083312301. Local number, 24N 7E 13ADADI.
LOCATION.--Lat 44°28'39", long 83°31'23", Hydrologic Unit 04070007, 10 mi west of Oscoda. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 69 ft, screened 54 to 69 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 760 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land surface datum.
PERIOD OF RECORD.--June 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 25.49 ft below land surface datum, Sept. 25, 1986; lowest measured, 32.71 ft below land surface datum, Mar. 23, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 2	29.44	JAN 15	29.78	MAR 1	29.74	MAY 26	28.68	JUL 22	29.04	AUG 25	28.36
DEC 1	29.61	FEB 3	29.89	APR 6	29.52						

IRON COUNTY

461257088542001. Local number, 44N 37W 14BBCA.
LOCATION.--Lat 46°12'57", long 88°54'20", Hydrologic Unit 04030106, at Federal Forest Highway 16, 0.5 mi south of Elmwood. Owner: Michigan Department of State Highways.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Driven water-table well, diameter 6 in., depth 102 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 1,730 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of plywood shelter base, 4.21 ft above land surface datum.
PERIOD OF RECORD.--October 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 90.57 ft below land-surface datum, Sept. 25, 1986; lowest measured, 97.11 ft below land surface datum, Aug. 16, 1982.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 2	91.78	FEB 25	91.27	MAY 19	92.60	SEP 14	92.64

JACKSON COUNTY

421346084230801. Local number, 3S 1W 11AADD1.
LOCATION.--Lat 42°13'46", long 84°23'08", Hydrologic Unit 04050004, at Belden and Mansion Streets in Jackson. Owner: City of Jackson.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 16 in., depth 360 ft, open bottom.
INSTRUMENTATION.--Daily measurement by observer; lowest monthly reading shown.
DATUM.--Elevation of land surface datum is 935 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood recorder shelf, 5.50 ft above land surface datum.
REMARKS.--Water levels affected by pumping.
PERIOD OF RECORD.--June 1957 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level mersured, 18.6 ft below land surface datum, Jan. 2, 1961; lowest measured, 122.0 ft below land surface datum, July 8, 1988.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 23	64.1	DEC 18	65.7	FEB 12	74.5	APR 15	78.1	JUN 14	113.8	AUG 3	97.4
NOV 20	70.7	JAN 29	68.3	MAR 8	75.2	MAY 31	104.9	JUL 8	122.0	SEP 29	81.9

KALAMAZOO COUNTY

421325085404801. Local number, 3S 12W 11BDAD.
LOCATION.--Lat 42°13'25", long 85°04'48", Hydrologic Unit 04050003, at Kalamazoo Valley Community College. Owner: City of Kalamazoo
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 3 in., depth 248 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land surface datum is 880 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--March 1961 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, +2.98 ft above land surface datum, Sept. 4, 1969; lowest recorded, 1.10 ft below land-surface datum, July 14, 15, 1988.

WATER LEVEL, IN FEET ABOVE (+) AND BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	.24	.25	.24	---	---	.08	---	---	.87	.98	.99	.60
10	.24	.27	.23	---	---	+.03	---	---	.91	1.02	.94	.58
15	.25	.30	.07	.17	.08	+.07	---	---	.95	1.10	.93	.45
20	.24	.29	---	.15	.08	+.10	---	.78	.96	.95	.95	.30
25	.22	.22	---	.13	---	---	---	.82	.95	.88	.94	.22
EOM	.24	.20	---	.14	.08	---	---	.86	.92	.94	.99	.23

WTR YR 1988 HIGHEST +0.28 DEC 15, 1987 LOWEST 1.10 JUL 14, 15, 1988

KENT COUNTY

425030085434901. Local number, 5N 12W 4DCCD.
LOCATION.--Lat 42°50'30", long 85°43'49", Hydrologic Unit 04050006, 0.4 mi west of Byron Center Road, 2.1 mi north of Byron Center. Owner: City of Wyoming.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 86 ft.
INSTRUMENTATION.--Monthly measurement. Water-level recorder October 1962 to July 1978.
DATUM.--Elevation of land surface datum is 685.97 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of shelter base, 2.50 ft above land surface datum.
PERIOD OF RECORD.--October 1962 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 8.28 ft below land-surface datum, Apr. 14, 1974; lowest recorded, 12.91 ft below land-surface datum, Aug. 19, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 7	10.04	FEB 11	9.44	MAY 11	9.85	JUN 21	11.13	AUG 4	11.60	SEP 15	11.42
JAN 7	9.85	MAR 17	9.79								

LAKE COUNTY

440737085483701. Local number, 20N 13W 13ACAC1.
LOCATION.--Lat 44°07'37", long 85°48'37", Hydrologic Unit 04060103, 5 mi east of Irons. Owner: U.S. Geological Survey.
AQUIFER.--Outwash deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water table well, diameter 6 in., depth 57 ft, screened 42 to 57 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land surface datum is 945 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--March 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 9.13 ft below land-surface datum, Oct. 8, Nov. 12, 1986; lowest measured, 17.71 ft below land-surface datum, Mar. 14, 1980.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 8	11.66	DEC 29	11.39	MAR 31	11.22	JUN 16	10.91	JUL 29	11.71	AUG 30	12.28
NOV 20	11.96	FEB 26	11.03	MAY 3	10.34						

LEELANAU COUNTY

445020086012201. Local number, 28N 14W 8DDCA1.
LOCATION.--Lat 44°50'20", long 86°01'22", Hydrologic Unit 04060104, 2.5 mi northeast of Empire.
Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 138 ft, screened 123 to 138 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 750 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--February 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 111.25 ft below land-surface datum, Apr. 7, 1987; lowest measured, 114.49 ft below land-surface datum, June 21, 1983.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 29	111.78	JAN 21	112.10	APR 14	112.22	MAY 23	112.15	JUL 7	112.01	AUG 16	111.91
DEC 15	111.71	MAR 3	112.17								

445011086031401. Local number, 28N 14W 18BABB1.
LOCATION.--Lat 44°50'11", long 86°03'14", Hydrologic Unit 04060104, 2 mi north of Empire.
Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 60 ft, screened 45 to 60 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 625 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--November 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 20.79 ft below land-surface datum, Oct. 14, 15, 1986; lowest recorded, 24.76 ft below land-surface datum, Sept. 29, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	23.27	23.40	22.89	22.64	22.63	22.86	22.62	22.37	22.81	23.22	23.51	23.77
10	23.33	23.39	22.87	22.64	22.47	22.92	22.47	22.46	22.90	23.26	23.57	23.80
15	23.33	23.16	22.83	22.66	22.40	22.95	22.10	22.54	22.96	23.33	23.60	23.84
20	23.34	22.96	22.76	22.69	22.51	22.97	22.01	22.60	23.03	23.37	23.65	23.87
25	23.37	22.91	22.71	22.76	22.67	22.98	22.14	22.67	23.10	23.41	23.68	23.90
EOM	23.39	22.88	22.64	22.84	22.77	22.75	22.26	22.75	23.16	23.47	23.73	23.92

WTR YR 1988 HIGHEST 21.98 APR 20, 1988 LOWEST 23.92 SEP 28,29,30, 1988

LENAWEE COUNTY

420246084150601. Local number, 5S 1E 12DDBD.
LOCATION.--Lat 42°02'46", long 84°15'06", Hydrologic Unit 04100002, in the Onsted State Game Area, 2 mi west of Cambridge Junction. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 39 ft, screened 36 to 39 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,000 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.50 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 15.89 ft below land-surface datum, Mar. 26, 1982; lowest measured, 19.33 ft below land-surface datum, Sept. 2, 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 15	17.18	JAN 22	16.60	APR 8	16.16	MAY 20	16.86	JUL 11	18.33	AUG 19	17.98
DEC 11	16.74	MAR 4	16.58								

LIVINGSTON COUNTY

422853083402801. Local number, 1N 6E 13DBAB.
LOCATION.--Lat 42°28'53", long 83°40'28", Hydrologic Unit 04090005, at Twelve Mile Road, 2 mi northwest of South Lyon. Owner: American Aggregate Corporation.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 2 in., depth 29 ft, 1.25 in. diameter screen.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 930 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--April 1970 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.1 ft below land-surface datum, Apr. 22, 1974; lowest recorded, 21.58 ft below land-surface datum, Oct. 30, 31, Nov. 1, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	16.53	16.76	16.85	16.47	16.37	16.18	15.68	15.22	15.32	15.81	15.85	15.95
10	16.59	16.79	16.67	---	16.33	16.12	15.43	15.18	15.31	15.79	15.81	16.11
15	16.66	16.82	16.60	---	16.28	16.01	15.35	15.18	15.39	15.80	16.03	16.09
20	16.74	16.83	16.50	16.36	16.24	15.99	15.28	15.17	15.49	15.84	15.81	16.24
25	16.76	16.85	16.48	16.37	16.22	15.92	15.26	15.26	15.47	15.86	15.83	16.00
EOM	16.77	16.85	16.48	16.38	16.19	15.88	15.26	15.44	15.57	15.90	15.96	15.96

WTR YR 1988 HIGHEST 15.17 MAY 8, 9, 10, 15, 16, 19, 20, 21, 22, 1988 LOWEST 16.88 DEC 7, 8, 1987

MACKINAC COUNTY

460321084354801. Local number, 42N 2W 7AABB.
LOCATION.--Lat 46°03'21", long 84°35'48", Hydrologic Unit 04070002, at Pontchartrain and St. Ignace Roads, 2 mi north of Pontchartrain Shores. Owner: U.S. Forest Service.
AQUIFER.--Manistique Dolomite of Silurian age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 102 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 650 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter floor, 2.30 ft above land-surface datum.
PERIOD OF RECORD.--June 1956 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.49 ft below land-surface datum, Apr. 21, 1985; lowest recorded, 32.3 ft below land-surface datum, Feb. 7, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	25.96	23.32	23.24	24.37	25.80	27.09	14.85	21.88	24.06	26.78	28.22	27.24
10	26.67	23.34	23.17	24.77	26.10	26.98	16.50	22.48	24.63	27.07	28.35	27.57
15	26.74	24.13	21.93	25.13	26.17	26.87	18.53	21.95	25.12	27.40	28.44	27.84
20	24.28	24.60	22.94	25.40	26.38	26.91	20.06	21.80	25.50	27.51	27.60	27.83
25	24.90	24.10	23.54	25.83	26.67	26.88	20.83	22.74	25.90	27.83	27.90	28.06
EOM	24.90	23.61	23.81	26.11	26.92	22.48	21.32	23.54	26.34	28.25	26.73	28.11

WTR YR 1988 HIGHEST 14.44 APR 6, 1988 LOWEST 28.52 OCT 1, 1987

MARQUETTE COUNTY

462938087475901. Local number, 47N 28W 3CCDC.
LOCATION.--Lat 46°29'38", long 87°47'59", Hydrologic Unit 04020105, on U.S Highway 41 and State Highway 28, and 4.8 mi west of Ishpeming. Owner: Ely Township.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 72 ft, screened 68 to 72 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 1,571.99 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder base, 3.00 ft above land-surface datum.
REMARKS.--Federal key well.
PERIOD OF RECORD.--August 1961 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 9.41 ft below land-surface datum, Apr. 21, 1985; lowest recorded, 19.26 ft below land-surface datum, Apr. 10, 11, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	16.75	16.23	15.53	15.21	15.68	16.13	14.94	13.40	13.76	14.58	15.12	14.27
10	16.74	16.25	15.44	15.25	15.77	16.20	13.23	13.48	13.88	14.72	14.97	14.35
15	16.65	16.27	15.09	15.31	15.82	16.25	13.28	13.45	14.02	14.86	14.92	14.44
20	16.60	15.98	15.01	15.41	15.91	16.31	13.30	13.54	14.14	14.98	14.26	14.45
25	16.56	15.67	15.09	15.50	15.99	16.30	13.33	13.63	14.29	15.10	14.10	14.47
EOM	16.35	15.56	15.14	15.60	16.06	16.00	13.37	13.67	14.43	15.25	14.22	14.32

WTR YR 1988 HIGHEST 13.21 APR 12, 13, 1988 LOWEST 16.82 OCT 2, 3, 1987

MENOMINEE COUNTY

453504087331301. Local number, 37N 26W 19DADA.
LOCATION.--Lat 45°35'04", long 87°33'13", Hydrologic Unit 04030108, at U.S. Highway 41 at Carney. Owner: Michigan Department of State Highways.
AQUIFER.--Trenton Limestone and Black River Formation of Middle Ordovician age.
WELL CHARACTERISTICS.--Water-table well, diameter 4 in., depth 17 ft, cased.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 800 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of 2 in. reducing nipple, 1.26 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--September 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.32 ft below land-surface datum, Mar. 31, 1986; lowest measured, 8.62 ft below land-surface datum, Jan. 17, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 9	4.45	MAR 30	3.67	MAY 19	5.10	SEP 15	6.46

MONROE COUNTY

415206083414401. Local number, 7S 6E 15ACAA.
LOCATION.--Lat 41°52'06", long 83°41'44", Hydrologic Unit 04100002, at Teal Road, 2 mi southeast of Petersburg. Owner: U.S. Geological Survey.
AQUIFER.--Detroit River Group of Devonian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 72 ft, cased to 53 ft, open bottom.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 680 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--November 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 32.30 ft below land-surface datum, Mar. 2[illegible], 1982; lowest recorded, 46.54 ft below land-surface datum, July 9, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 29	39.58	JAN 21	36.67	APR 5	35.32	JUL 9	46.54	AUG 1[illegible]	44.45	[illegible]	[illegible]
DEC 10	36.22	MAR 3	35.8[illegible]	MAY 25	37.83						

415235083414001. Local number, 7S 6E 15ADBB.
LOCATION.--Lat 41°52'35", long 83°41'40", Hydrologic Unit 04100002, at Teal Road, 1.5 mi southeast of Petersburg. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 17 ft, screened 14 to 17 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 675 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.00 ft below land-surface datum, Feb. 14, 1966; lowest measured, 7.45 ft below land-surface datum, Aug. 18, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 29	6.86	JAN 21	6.06	APR 5	5.91	MAY 25	6.03	JUL 7	6.75	AUG 18	7.45
DEC 10	6.66	MAR 3	6.01								

OAKLAND COUNTY

425116083321501. Local number, 5N 8E 8ACAC.
LOCATION.--Lat 42°51'16", long 83°32'15", Hydrologic Unit 04080204, at Van Atta Road, 6 mi northeast of Holly. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 1.25 in., depth 42 ft, screened 39 to 42 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 930 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.00 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--November 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 22.30 ft below land-surface datum, Apr. 24, 1974; lowest measured, 26.48 ft below land-surface datum, Sept. 9, 1966.

WATER LEVEL IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 8	26.08	DEC 29	25.29	MAR 22	25.05	JUN 2	25.49	JUN 29	26.31	SEP 7	26.37
NOV 19	25.80	FEB 9	25.28	MAY 3	24.95	JUN 14	25.83	JUL 26	26.29		

OCEANA COUNTY

433133086082601. Local number, 13N 15W 18AAAA.
LOCATION.--Lat 43°31'33", long 86°08'26", Hydrologic Unit 04060101, 6 mi southwest of Hesperia. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 79 ft, screened 69 to 79 ft.
INSTRUMENTATION.--Water-level recorder. Monthly measurements August 1977 to July 1979.
DATUM.--Elevation of land-surface datum is 703 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--August 1977 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 35.76 ft below land-surface datum, Dec. 2, 3, 1986; lowest recorded, 40.99 ft below land-surface datum, Mar. 28, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	39.25	39.64	40.00	40.10	39.79	39.37	39.06	38.85	38.58	38.60	38.93	39.27
10	39.33	39.70	40.04	40.05	39.76	39.29	39.05	38.80	38.57	38.61	38.98	39.33
15	39.38	39.76	40.09	39.97	39.67	39.22	39.02	38.74	38.54	38.71	39.04	39.39
20	39.44	39.83	40.14	39.90	39.60	39.18	38.99	38.69	38.52	38.76	39.09	39.45
25	39.51	39.89	40.18	39.87	39.53	39.12	38.96	38.66	38.53	38.82	39.14	39.51
EOM	39.59	39.93	40.13	39.83	39.45	39.12	38.90	38.61	38.54	38.88	39.22	39.55

WTR YR 1988 HIGHEST 38.50 JUN 22,25, 1988 LOWEST 40.19 DEC 26,27,29,30, 1987

OGEMAW COUNTY

442514084164702. Local number, 23N 1E 2BAAA.
LOCATION.--Lat 44°25'14", long 84°16'47", Hydrologic Unit 04070007, at south side of Rose City Road, and 8 mi west of Rose City. Owner: Ogemaw County Road Commission.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 20 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 1,265 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.30 ft above land-surface datum.
PERIOD OF RECORD.--November 1968 to October 1971, April 1974 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 7.62 ft below land-surface datum, Apr. 13, 1976; lowest measured, 13.6 ft below land-surface datum, December 1972.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 14	11.83	MAR 25	11.67	APR 25	10.28	JUL 27	11.40

ONTONAGON COUNTY

465002089321601. Local number, 51N 41W 8BDBC.
LOCATION.--Lat 46°50'02", long 89°32'16", Hydrologic Unit 04020101, 325 ft south of State Highway 64, 1.5 mi east of Silver City. Owner: Michigan Department of Corrections.
AQUIFER.--Freda Sandstone of Keweenawan age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 100 ft, cased to 32 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 3.50 ft above land-surface datum.
PERIOD OF RECORD.--October 1958 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.20 ft below land-surface datum, Apr. 15, 1959; lowest measured, 21.82 ft below land-surface datum, Dec. 15, 1976.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 3	10.11	FEB 24	10.72	MAY 17	9.21	AUG 11	17.19

OTSEGO COUNTY

445920084425801. Local number, 30N 3W 19ABBB.
LOCATION.--Lat 44°59'20", long 84°42'58", Hydrologic Unit 04070007, at Old Alba Road, 3 mi southwest of Gaylord. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 87 ft, screened 72 to 87 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,307 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.---January 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured 30.56 ft below land-surface datum, Dec. 10, 1986; lowest measured, 35.82 ft below land-surface datum, Apr. 1, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 1	32.55	DEC 16	33.18	MAR 8	33.37	MAY 27	31.53	JUL 11	31.90	AUG 17	32.33
NOV 12	32.95	JAN 28	33.37	APR 13	33.00						

PRESQUE ISLE COUNTY

451634083441801. Local number, 33N 6E 8BBBB.
LOCATION.--Lat 45°16'34", long 83°44'18", Hydrologic Unit 04070006, at south side of Grand Lake Highway, and 2 mi west and 1 mi north of Posen. Owner: A. Styma.
AQUIFER.--Traverse Group.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 61 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 0.50 ft above land-surface datum.
PERIOD OF RECORD.--December 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 5.10 ft below land-surface datum, Mar. 2, 1979; lowest measured, 16.83 ft below land-surface datum, Mar. 5, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 3	11.45	MAR 7	10.50	JUN 7	10.71	JUL 21	13.80

ROSCOMMON COUNTY

442722084350701. Local number, 24N 2W 20BABA.
LOCATION.--Lat 44°27'22", long 84°35'07", Hydrologic Unit 04070007, at State Highway 103, 2 mi south of Roscommon. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Jetted water-table well, diameter 8 in., depth 14 ft, open bottom.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 1,145.30 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 2.50 ft above land-surface datum.
REMARKS.--Federal key well.
PERIOD OF RECORD.--December 1934 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 2.29 ft below land-surface datum, Apr. 19, 1985; lowest recorded, 6.23 ft below land-surface datum, Dec. 6-11, 1949.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.39	5.28	5.07	4.89	4.75	4.97	3.93	4.01	4.51	5.18	5.45	5.29
10	5.38	5.26	5.02	4.92	4.79	4.89	3.75	4.09	4.62	5.30	5.43	5.35
15	5.38	5.29	4.96	4.96	4.83	4.92	3.76	4.15	4.75	5.33	5.51	5.37
20	5.38	5.33	4.92	4.96	4.86	4.98	3.83	4.23	4.89	5.40	5.52	5.36
25	5.37	5.35	4.89	5.00	4.89	4.88	3.91	4.31	4.96	5.43	5.49	5.16
EOM	5.32	5.32	4.88	5.00	4.92	4.35	3.95	4.41	5.05	5.46	5.29	5.19

WTR YR 1988 HIGHEST 3.73 APR 11,12,13,14, 1988 LOWEST 5.54 AUG 22,23, 1988

SAGINAW COUNTY

431457084194401. Local number, 10N 1E 22DADA1.
LOCATION.--Lat 43°14'57", long 84°19'44", Hydrologic Unit 04080203, at west side of Merrill Road, 0.35 mi north of Marion Springs. Owner: U.S. Geological Survey.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 210 ft, cased to 170 ft.
INSTRUMENTATION.--Water level recorder.
DATUM.--Elevation of land-surface datum is 657 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--December 1977 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 7.93 ft below land-surface datum, Feb. 10, 1981; lowest recorded, 10.92 ft below land-surface datum, Sept. 1, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	10.40	10.25	10.03	9.69	---	9.47	9.27	9.28	9.72	10.18	10.32	10.54
10	10.56	10.31	9.86	---	---	9.38	9.36	9.23	9.82	10.26	10.40	10.65
15	10.47	10.24	9.86	---	9.31	9.42	9.29	9.21	9.83	10.39	10.42	10.70
20	10.37	10.20	9.71	---	9.28	9.44	9.22	9.29	9.85	10.26	10.44	10.49
25	10.41	10.21	9.72	---	9.39	9.36	9.23	9.39	9.92	10.26	10.43	10.52
EOM	10.38	9.88	9.68	---	9.45	9.47	9.27	9.54	10.08	10.27	10.87	10.56

WTR YR 1988 HIGHEST 9.08 APR 23, 1988 LOWEST 10.92 SEP 1, 1988

SANILAC COUNTY

433439082523601. Local number, 13N 13E 12ADAA.
LOCATION.--Lat 43°34'39", long 82°52'36", Hydrologic Unit 04090001, at Wheatland Road, 3 mi east and 0.75 mi north of Argyle. Owner: U.S. Geological Survey.
AQUIFER.--Marshall Formation of Mississippian age.
WELL CHARACTERISTICS.--Drilled artesian observation well, diameter 6 in., depth 130 ft, cased with plastic pipe to 48 ft, open bottom.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 805 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--October 1976 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 15.54 ft below land-surface datum, Apr 6, 1985; lowest recorded, 22.71 ft below land-surface datum, Nov. 20, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	21.34	21.02	19.95	19.17	19.07	19.31	17.83	18.00	19.22	20.88	21.54	21.97
10	21.45	20.97	19.56	19.40	19.22	18.57	17.90	18.16	19.48	21.14	21.69	21.89
15	21.46	20.94	19.50	19.53	19.21	18.37	17.88	18.25	19.80	21.40	21.81	21.97
20	21.48	20.89	19.26	19.25	19.20	18.43	17.88	18.43	20.10	21.55	21.90	22.03
25	21.24	20.88	18.78	19.34	19.21	18.19	17.73	18.70	20.34	21.51	21.99	22.07
EOM	21.06	20.06	18.87	19.32	19.28	18.11	17.86	19.04	20.60	21.45	22.15	22.11

WTR YR 1988 HIGHEST 17.61 APR 23, 1988 LOWEST 22.20 SEP 3,4, 1988

SCHOOLCRAFT COUNTY

461720085565201. Local number, 45N 13W 16CCCB.
LOCATION.--Lat 46°17'20", long 85°56'52", Hydrologic Unit 04060106, at headquarters building of Seney Wildlife Refuge. Owner: U.S. Fish and Wildlife Service.
AQUIFER.--Limestones of Upper Ordovician age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 151 ft, cased to 65 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 710 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.60 ft below land-surface datum.
PERIOD OF RECORD.--June 1952 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 4.64 ft below land-surface datum, Apr. 13, 1971; lowest recorded, 6.50 ft below land-surface datum, Oct. 23, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.86	5.76	5.64	5.49	5.38	5.34	5.09	5.55	5.69	6.03	5.98	5.65
10	5.93	5.80	5.52	5.47	5.38	5.32	5.45	5.57	5.83	6.06	6.03	5.73
15	5.92	5.79	5.55	5.41	5.30	5.29	5.40	5.49	5.90	6.09	6.02	5.72
20	5.86	5.67	5.48	5.40	5.30	5.28	5.45	5.56	5.83	5.91	5.75	5.62
25	5.84	5.68	5.50	5.38	5.33	5.24	5.45	5.63	5.85	5.96	5.67	5.67
EOM	5.83	5.58	5.48	5.39	5.36	5.31	5.51	5.63	5.93	6.04	5.65	5.64

WTR YR 1988 HIGHEST 4.94 APR 6, 1988 LOWEST 6.09 JUL 14,15, 1988

VAN BUREN COUNTY

421945085481502. Local number, 2S 13W 2BBCB2.
LOCATION.--Lat 42°19'45", long 85°48'15", Hydrologic Unit 04050001, at Fish Lake Road, 2.5 mi north of State Highway 43, and 16 mi east of Bangor. Owner: Van Buren County Road Commission.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 40 ft, screened 36 to 40 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 737 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 1.00 ft above land-surface datum.
PERIOD OF RECORD.--May 1981 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.38 ft below land surface datum, Oct. 6, 1986; lowest measured, 12.58 ft below land surface datum, Sept. 19, 1984.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 20	11.03	JAN 14	10.41	APR 7	10.12	JUN 29	11.96	AUG 9	12.57	SEP 20	12.47
DEC 3	10.51	FEB 18	10.26	MAY 18	10.69						

WASHTENAW COUNTY

421228083331601. Local number, 3S 7E 24CADB.
LOCATION.--Lat 42°12'28", long 83°33'16", Hydrologic Unit 04090005, at Bridge Street, and at Ypsilanti Township Waterworks. Owner: Ypsilanti Township.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 4 in., depth 80 ft, screened 77 to 80 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 665.65 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of coupling, 3.00 ft above land-surface datum.
REMARKS.--Water level affected by nearby pumping.
PERIOD OF RECORD.--July 1943 to June 1945, December 1949 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 5.79 ft below land-surface datum, Jan. 5, 1950; lowest recorded, 22.66 ft below land-surface datum, Feb. 13, 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	16.65	15.99	15.81	14.94	14.92	15.10	14.64	15.23	14.79	15.26	14.96	14.28
10	16.74	16.13	15.66	15.18	---	14.81	14.97	14.63	14.94	15.31	15.01	14.46
15	16.46	16.23	15.69	15.33	---	14.72	15.25	14.45	15.00	15.33	14.94	14.58
20	16.39	16.14	15.28	14.95	---	15.06	15.29	14.22	15.03	15.15	14.76	14.68
25	16.32	16.19	14.93	15.10	---	15.07	15.37	14.19	15.02	14.91	14.50	14.77
EOM	16.16	15.58	14.72	15.06	---	15.20	15.38	14.47	15.09	14.87	14.51	14.86

WTR YR 1988 HIGHEST 14.11 MAY 24, 1988 LOWEST 16.76 OCT 8,9, 1987

TEMPERATURE OF GROUND WATER

Temperatures of ground water are measured as part of a state-wide water resource investigation in cooperation with the Michigan Department of Natural Resources. The purpose of these measurements is to determine the natural ground-water temperature of selected points throughout the State. These data can be used to estimate ground-water temperatures in many areas in the State. Measurements of temperature were made by means of "lazy" thermometers (Heath, 1964).

TEMPERATURE (°C) OF GROUND WATER AT INDICATED DEPTH, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988

DATE	WATER TEMPERATURE (°C)	DATE	WATER TEMPERATURE (°C)	DATE	WATER TEMPERATURE (°C)
ALGER COUNTY, 45N 19W 25BDCD (LAT 46°16'08", LONG 86°37'38") DEPTH 66 FT					
DEC 3	8.0	JUN 9	7.2	SEP 2	8.0
MAR 9	7.2				
DICKINSON COUNTY, 43N 28W 32ADAB (LAT 46°04'58", LONG 87°49'39") DEPTH 31 FT					
OCT 26	8.5	MAR 3	7.0	JUN 23	5.9
DEC 1	8.3	MAR 28	6.6	JUL 27	6.3
DEC 30	8.0	APR 27	6.2	AUG 30	7.0
JAN 28	7.6	MAY 24	5.8	SEP 28	7.7
LENAWEE COUNTY, 5S 1E 12DDBD (LAT 42°02'46", LONG 84°15'06") DEPTH 39 FT					
OCT 15	10.1	MAR 4	10.0	JUL 11	8.9
DEC 11	10.4	APR 8	9.5	AUG 19	9.1
JAN 22	10.3	MAY 20	9.1		
MENOMINEE COUNTY, 37N 26W 19DADA (LAT 45°35'04", LONG 87°33'13") DEPTH 17 FT					
DEC 9	9.6	MAY 19	6.4	SEP 15	11.6
MAR 30	6.0				
OAKLAND COUNTY, 5N 8E 8ACAC (LAT 42°51'16", LONG 83°32'15") DEPTH 42 FT					
OCT 8	9.5	MAR 22	10.0	JUN 29	10.0
NOV 19	10.0	MAY 3	10.0	JUL 26	10.0
DEC 29	10.0	JUN 2	10.0	SEP 7	10.0
FEB 9	10.5	JUN 14	10.0		

The following continuous-record streamflow or stage stations in Michigan have been discontinued or converted to partial-record stations. The column headed "Period of record" shows the water years in which daily streamflow or stage records were collected and published.

Station No.	Station Name	Drainage area (mi^2)	Period of record
	STREAMS TRIBUTARY TO LAKE SUPERIOR		
04028000	Montreal River at Ironwood, MI	63.0	1918-22, 1924-26, 1949-54
04030000	Montreal River near Saxon, WI	262	1938-70
04030500	Black River at Ramsay, MI	a82	1924-25
04031000	Black River near Bessemer, MI	200	1955-82
04031500	Presque Isle River at Marenisco, MI	171	1945-82
04032000	Presque Isle River near Tula, MI	261	*1945-73
04032500	Iron River near White Pine, MI	98.1	1952-57
04035000	East Branch Ontonagon River near Mass, MI	272	1942-79
04038000	Cisco Branch Ontonagon River near Watersmeet, MI	62.2	1942-44
04039500	South Branch Ontonagon River at Ewen, MI	348	*1942-71
04041000	Perch River near Sidnaw, MI	63.1	*1913-15
04042000	Sturgeon River near Baraga, MI	379	1927-31, 1943-47
04042500	Otter River near Elo, MI	162	*1942-72
04043000	Sturgeon River near Arnheim, MI	705	1942-74
04043500	Dead River near Negaunee, MI	138	1902-03
04044000	Dead River at Forestville, MI	158	1899-1902
04044400	Carp River near Negaunee, MI	51.4	1961-87
04044500	Carp River near Marquette, MI	a86	1902-04
04044563	Big Creek near Harvey, MI	17.0	1979-81
04044573	Cedar Creek near Harvey, MI	9.04	1979-81
04044583	Cherry Creek near Harvey, MI	4.53	1965-70, 1979-81
04044595	Silver Creek at Harvey, MI	8.58	1979-81
04045000	Tahquamenon River at Newberry, MI	a200	1934-36
	STREAMS TRIBUTARY TO LAKE MICHIGAN		
04046000	Black River near Garnet, MI	a28	*1951-78
04046500	South Manistique Lake Outlet at Curtis, MI	a44	1942-44
04047000	North Manistique Lake Outlet at Helmer, MI	a15	1942-44
04047500	Manistique River near Germfask, MI	a120	1942-50
04048000	Fox River at Seney, MI	107	1942-44
04048500	East Branch Fox River near Germfask, MI	104	1942-44
04049000	Holland Creek near Seney, MI	a13	1938-42
04049500	Manistique River at Germfask, MI	341	*1938-70
04050000	Goose Pen Outlet at Germfask, MI	--	1939-41
04050500	Grays Creek near Germfask, MI	a36	1938-40
04051000	Pine Creek near Germfask, MI	a11	1938-40
04051500	Sand Creek near Germfask, MI	a6	1938-40
04052000	Driggs River near Seney, MI	a70	1938-42
04052500	Walsh Creek near Seney, MI	a12	1938-42
04053000	Driggs River near Germfask, MI	114	1938-41
04053500	Marsh Creek near Shingleton, MI	a20	1938-42
04054000	Marsh Creek near Germfask, MI	--	1938-41
04054500	Duck Creek near Blaney, MI	a92	1938-54
04055000	Manistique River near Blaney, MI	704	*1938-70
04055500	Creighton River near Shingleton, MI	a35	1938-42
04056000	West Branch Manistique River near Manistique, MI	322	1938-56
04057000	Indian River near Manistique, MI	302	*1938-71
04057500	Sturgeon River near St. Jacques, MI	167	1950-52
04057820	Middle Branch Escanaba River near Greenwood, MI	73.3	*1973-82
04057900	Black River near Republic, MI	34.4	*1961-68
04058000	Middle Branch Escanaba River near Ishpeming, MI	128	1954-75
04058100	Middle Branch Escanaba River near Princeton, MI	210	1961-82
04058130	Green Creek near Princeton, MI	13.8	1977-82
04058300	Warner Creek near Palmer, MI	14.2	*1961-68, 1972-78
04058400	Goose Lake Outlet near Sands Station, MI	37.5	*1966-82

See footnotes at end of table.

Station No.	Station Name	Drainage area (mi²)	Period of record
	STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued		
04058500	East Branch Escanaba River at Gwinn, MI	124	1955-80
04059400	Tenmile Creek at Perronville, MI	38.4	*1971-77
04060000	Iron River near Iron River, MI	a65	1901-04
04060500	Iron River at Caspian, MI	92.1	1948-80
04062100	Peshekee River near Michigamme, MI	66.5	1961-68
04062200	Peshekee River near Champion, MI	133	*1961-78
04062230	Michigamme River near Michigamme, MI	194	1969-82
04062270	Michigamme River near Champion, MI	231	1964-69
04062300	Michigamme River at Republic, MI	240	*1961-75
04062400	Michigamme River near Witch Lake, MI	316	1964-80
04065000	Menominee River near Iron Mountain, MI	a2,420	1898-99, 1903-14
04065300	West Branch Sturgeon River near Randville, MI	56.1	1958-81
04065393	East Branch Sturgeon River below Skunk Creek near Felch, MI	61.8	1974-84
04065397	East Branch Sturgeon River at Hardwood, MI	90.8	1978-83
04065500	Sturgeon River near Foster City, MI	237	1955-80
04065600	Pine Creek near Iron Mountain, MI	16.8	1972-81
04067000	Menominee River below Koss, MI	3,730	1907-09, 1913-81
04095500	Galien River near New Troy, MI	a47	1945-47
04096000	East Branch Galien River near New Troy, MI	19.2	1945-47
04096272	Beebe Creek near Hillsdale, MI	42.4	*1974-78
04096312	Sand Creek at Litchfield, MI	20.6	*1974-77
04096325	Soap Creek near Litchfield, MI	10.9	1975-77
04096340	St. Joseph River at Clarendon, MI	144	*1974-77
04096500	Sauk (East Branch Coldwater) River at Coldwater, MI	--	1938-62
04097000	St. Joseph River at Mendon, MI	918	1903-05
04097060	Little Portage Creek near Fulton, MI	27.0	*1965-67
04097170	Portage River near Vicksburg, MI	68.2	*1946-51, 1965-80
04097200	Gourdneck Creek near Schoolcraft, MI	7.29	1964-73
04097500	St. Joseph River at Three Rivers, MI	1,350	1953-83
04098500	Fawn River near White Pigeon, MI	192	*1903-04, 1958-75
04102000	St. Joseph River at Berrien Springs, MI	4,081	*1901-07, 1909-32, 1951-56
04102320	Paw Paw River near Paw Paw, MI	195	1980-82
04102420	Paw Paw River near Hartford, MI	311	1980-82
04102850	South Branch Kalamazoo River near Albion, MI	146	1972-76
04103000	Reed's Springs near Albion, MI	--	1905-06
04103500	Kalamazoo River at Marshall, MI	449	1949-82
04104000	Battle Creek at Charlotte, MI	a67	1948-54
04104500	Battle Creek at Bellevue, MI	178	1948-53
04105800	Gull Creek near Galesburg, MI	38.1	*1965-73
04106190	Portage Creek near Portage, MI	18.6	1965-67
04106500	Portage Creek at Kalamazoo, MI	46.8	1948-58, 1975-86
04107000	Gun River at dam near Shelbyville, MI	a30	1946-47
04107500	Gun River near Martin, MI	a35	1946-47
04108000	Kalamazoo River near Allegan, MI	a1,470	1903-08
04109500	Portage River below Little Portage Lake near Munith, MI	a55	1944-56
04110000	Orchard Creek at Munith, MI	a49	1944-56
04110500	Portage River near Munith, MI	118	1944-46
04111000	Grand River near Eaton Rapids, MI	661	1951-82
04112850	Sycamore Creek near Holt, MI	80.6	1975-80
04112904	Mud Lake Drain at Lansing, MI	4.28	1975-76
04113097	Carrier Creek near Lansing, MI	12.1	1975-80
04113500	Sebewa Creek near Sunfield, MI	24.1	1954-56
04115500	Fish Creek near Carson City, MI	145	1936-38
04116500	Flat River at Smyrna, MI	528	1951-86
04117000	Quaker Brook near Nashville, MI	7.60	*1954-75
04119300	Grand River at Eastmanville, MI	a5,230	1976-77
04120000	Crockery Creek at Slocums Grove, MI	--	1903
04120500	Higgins Lake Outlet (head of Muskegon River) near Roscommon, MI	b49.2	1942-50
04121000	Muskegon River near Merritt, MI	355	*1947-74
04123000	Big Sable River near Freesoil, MI	b115	*1942-74

See footnotes at end of table.

Station No.	Station Name	Drainage area (mi²)	Period of record
	STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued		
04123500	Manistee River near Grayling, MI	b123	*1943-74
04124500	East Branch Pine River near Tustin, MI	b60.0	*1952-63
04125000	Pine River near Le Roy, MI	b128	*1952-63
04125500	Pine River near Hoxeyville, MI	251	1952-82
04126200	Little Manistee River near Freesoil, MI	b178	*1957-75
04126500	Little Manistee River near Stronach, MI	b196	1931
04127500	Boardman River at Traverse City, MI	--	1903-04
	STREAMS TRIBUTARY TO LAKE HURON		
04128500	Indian River at Indian River, MI	b598	1942-82
04129500	Pigeon River at Afton, MI	b139	1942-81
04130000	Cheboygan River near Cheboygan, MI	b889	1943-82
04131000	Rainy River near Onaway, MI	b75.7	1942-52
04131500	Rainy River near Ocqueoc, MI	b87.9	*1953-79
04132000	Black River near Cheboygan, MI	b558	*1943-74
04132500	Thunder Bay River near Hillman, MI	232	*1945-73
04133000	Upper South Branch Thunder Bay River near Lachine, MI	171	1945-54
04133500	Thunder Bay River near Bolton, MI	588	1945-80
04134000	North Branch Thunder Bay River near Bolton, MI	184	1945-80
04134500	Lower South Branch Thunder Bay River near Hubbard Lake, MI	146	1945-54
04135600	East Branch Au Sable River at Grayling, MI	76.0	1958-84
04136000	Au Sable River near Red Oak, MI	a1,000	1909-16, 1931
04137000	Au Sable River at Bamfield, MI	a1,420	1902-14
04138000	East Branch Au Gres River at McIvor, MI	a84	*1951-74
04138500	Au Gres River near National City, MI	b154	1951-81
04139000	Houghton Creek near Lupton, MI	29.7	*1950-73
04139500	Rifle River at "The Ranch" near Lupton, MI	56.8	1950-71
04140000	Prior Creek near Selkirk, MI	21.4	*1950-73
04140500	Rifle River at Selkirk, MI	117	*1950-82
04141000	South Branch Shepards Creek near Selkirk, MI	1.15	*1952-78
04141500	West Branch Rifle River near Selkirk, MI	a52	*1952-63
04143000	Rifle River at Omer, MI	364	1902-04
04143500	North Branch Kawkawlin River near Kawkawlin, MI	101	1951-82
04144000	Shiawassee River at Byron, MI	365	1946-83
04145000	Shiawassee River near Fergus, MI	637	1940-84
04145500	Bad River near Brant, MI	a89	*1949-59
04146500	Flint River at Columbiaville, MI	470	1932-33, 1948-52
04147990	Butternut Creek near Genesee, MI	34.7	1970-84
04148000	Flint River at Genesee, MI	a593	1931-52
04148160	Gilkey Creek near Flint, MI	6.43	1970-84
04148200	Swartz Creek near Holly, MI	12.1	*1956-75
04148300	Swartz Creek at Flint, MI	115	1970-84
04148440	Thread Creek near Flint, MI	54.4	1970-84
04148720	Brent Run near Montrose, MI	20.8	1970-84
04149500	Flint River near Alicia, MI	--	‡1949-84
04150000	South Branch Cass River near Cass City, MI	238	1949-80
04151000	Cass River at Vassar, MI	710	*1910-28, 1949-70
04152500	Tobacco River at Beaverton, MI	487	1948-82
04153000	Kinney Creek near Clare, MI	a9	1935-36
04153500	Salt River near North Bradley, MI	138	1934-71
04154500	Chippewa River near Midland, MI	597	*1948-73
04156500	Tittabawassee River at Freeland, MI	a2,530	1903-10, 1912-36
04157500	Sebewaing River (State Drain) near Sebewaing, MI	b67.3	1940-54
04158500	Pigeon River near Owendale, MI	53.2	1953-82
04159000	Pigeon River near Pigeon, MI	b93.3	1947-52
	STREAMS TRIBUTARY TO ST. CLAIR RIVER		
04159488	Silver Creek near Jeddo, MI	20.6	1978-82
04160000	Mill Creek near Abbottsford, MI	185	*1947-64
04160050	Black River near Port Huron, MI	684	1931, 1933-44

See footnotes at end of table.

Station No.	Station Name	Drainage area (mi^2)	Period of record
	STREAMS TRIBUTARY TO LAKE ST. CLAIR		
04161000	Clinton River at Auburn Heights, MI	123	*1935-40, 1957-82
04161500	Paint Creek near Lake Orion, MI	38.5	*1955-75
04161820	Clinton River at Sterling Heights, MI	309	1979-83
04162000	Red Run near Royal Oak, MI	36.5	c1953-68
04162500	Bear Creek at Warren, MI	17.3	1954-57
04163000	Big Beaver Creek at Warren, MI	25.2	1954-58
04163500	Plum Brook near Utica, MI	22.9	1954-66
04163900	Red Run near Cady, MI	--	‡1980-82
04164010	North Branch Clinton River at Almont, MI	9.56	*1963-68
04164050	North Branch Clinton River near Romeo, MI	49.7	*1965-69
04164150	North Branch Clinton River near Meade, MI	89.6	*1968-72
04164200	Coon Creek near Armada, MI	10.0	*1966-70
04164250	Tupper Brook at Ray Center, MI	8.62	*1960-64
04164350	Highbank Creek near Armada, MI	14.9	*1965-70
04164360	East Branch Coon Creek near New Haven, MI	36.1	*1968-72
04164400	Deer Creek near Meade, MI	12.7	*1960-65
04164450	McBride Drain near Macomb, MI	5.79	*1960-64
04164600	Middle Branch Clinton River near Macomb, MI	22.2	*1965-69
04164800	Middle Branch Clinton River at Macomb, MI	41.0	*1963-68, 1970-82
04165000	Middle Branch Clinton River near Mount Clemens, MI	a51	1947-49
04165200	Gloede Ditch near Waldenburg, MI	16.0	*1959-64
04165556	Clinton River By-Pass below weir at Mount Clemens, MI	--	‡1980-83
04165557	Clinton River By-Pass at mouth at Mount Clemens, MI	--	‡1980-83
	STREAMS TRIBUTARY TO DETROIT RIVER		
04168500	Lower River Rouge at Dearborn, MI	b91.9	1931-33
	STREAMS TRIBUTARY TO LAKE ERIE		
04169000	Hayes Creek at Commerce, MI	a8	1946-51
04169500	Huron River at Commerce, MI	57.3	*1946-75
04171000	Davis Creek near Whitmore Lake, MI	b65.8	1953-54
04171500	Ore Creek near Brighton, MI	a31	1951-68
04172500	Portage River near Pinckney, MI	79.1	*1945-71
04173000	Huron River near Dexter, MI	522	*1904, 1946-72, 1976-77
04173500	Mill Creek near Dexter, MI	128	1952-83
04174000	Huron River at Dexter, MI	--	‡1904-16
04174800	Huron River at Ypsilanti, MI	807	1974-84
04175340	Stony Creek at Oakville, MI	68.0	1970-81
04175500	Huron River at Flat Rock, MI	851	1904-11, ‡1912-22
04175700	River Raisin near Tecumseh, MI	267	1956-80
04176400	Saline River near Saline, MI	94.6	*1966-77

* Previous or subsequent operation as a crest-stage partial-record station.
‡ Stage record only.
a Approximately.
b Revised.
c Records available in District Office only.

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October 1, 1978

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

The following factors may be used to convert the inch-pound units published herein to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI units
	Length	
inches (in)	2.54×10^{1}	millimeters (mm)
	2.54×10^{-2}	meters (m)
feet (ft)	3.048×10^{-1}	meters (m)
miles (mi)	1.609×10^{0}	kilometers (km)
	Area	
acres	4.047×10^{3}	square meters (m^2)
	4.047×10^{-1}	square hectometers (hm^2)
	4.047×10^{-3}	square kilometers (km^2)
square miles (mi^2)	2.590×10^{0}	square kilometers (km^2)
	Volume	
gallons (gal)	3.785×10^{0}	liters (L)
	3.785×10^{0}	cubic decimeters (dm^3)
	3.785×10^{-3}	cubic meters (m^3)
million gallons	3.785×10^{3}	cubic meters (m^3)
	3.785×10^{-3}	cubic hectometers (hm^3)
cubic feet (ft^3)	2.832×10^{1}	cubic decimeters (dm^3)
	2.832×10^{-2}	cubic meters (m^3)
cfs-days	2.447×10^{3}	cubic meters (m^3)
	2.447×10^{-3}	cubic hectometers (hm^3)
acre-feet (acre-ft)	1.233×10^{3}	cubic meters (m^3)
	1.233×10^{-3}	cubic hectometers (hm^3)
	1.233×10^{-6}	cubic kilometers (km^3)
	Flow	
cubic feet per second (ft^3/s)	2.832×10^{1}	liters per second (L/s)
	2.832×10^{1}	cubic decimeters per second (dm^3/s)
	2.832×10^{-2}	cubic meters per second (m^3/s)
gallons per minute (gal/min)	6.309×10^{-2}	liters per second (L/s)
	6.309×10^{-2}	cubic decimeters per second (dm^3/s)
	6.309×10^{-5}	cubic meters per second (m^3/s)
million gallons per day	4.381×10^{1}	cubic decimeters per second (dm^3/s)
	4.381×10^{-2}	cubic meters per second (m^3/s)
	Mass	
tons (short)	9.072×10^{-1}	megagrams (Mg) or metric tons

[illegible]